THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCII. No. 2218.] LONDON, NOVEMBER 14, 1905. [57TH YEAR. PRICE 6d.

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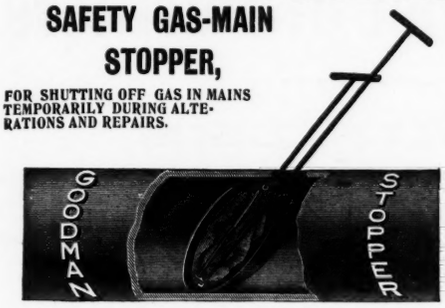

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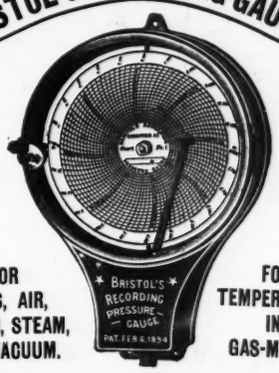

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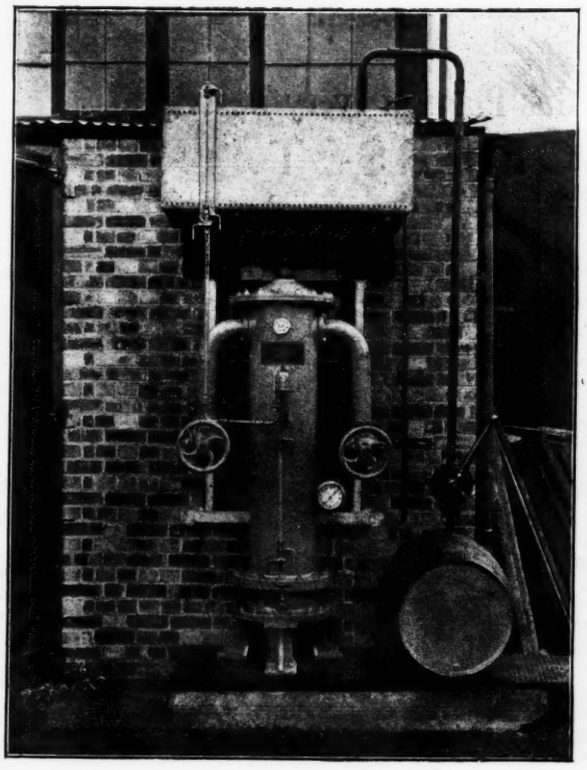

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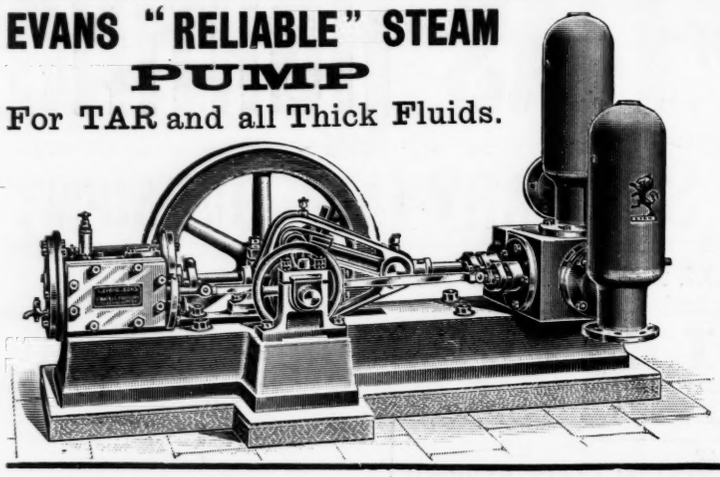

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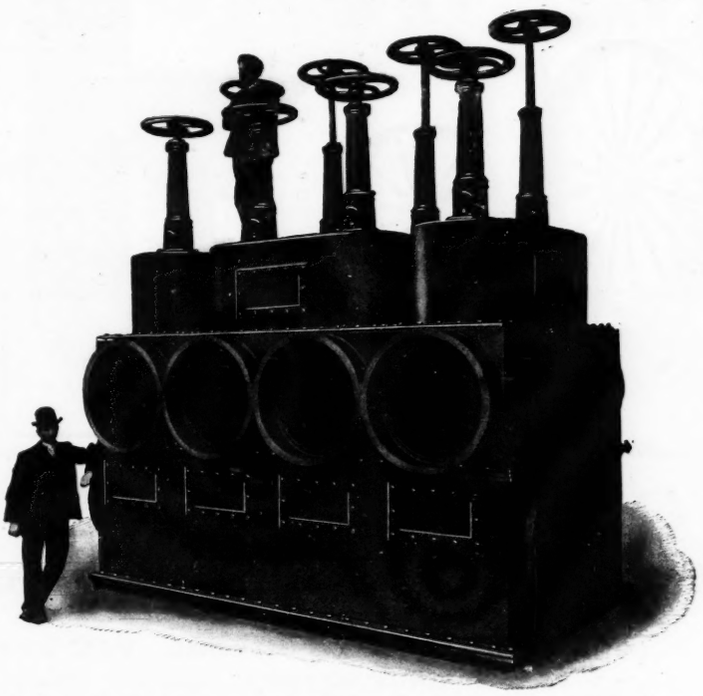

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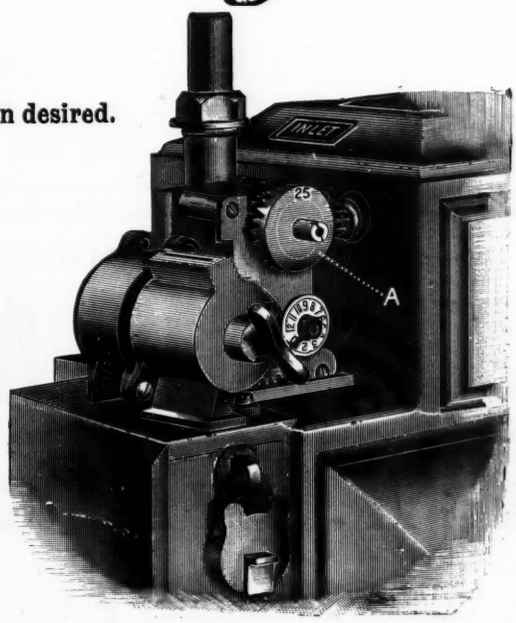

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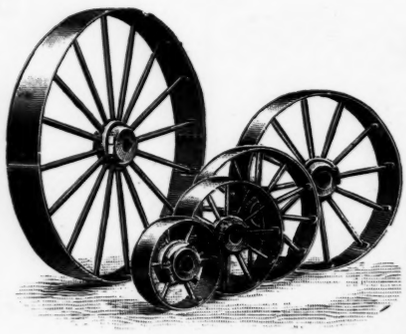

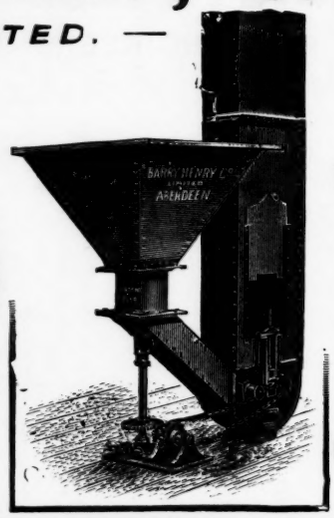

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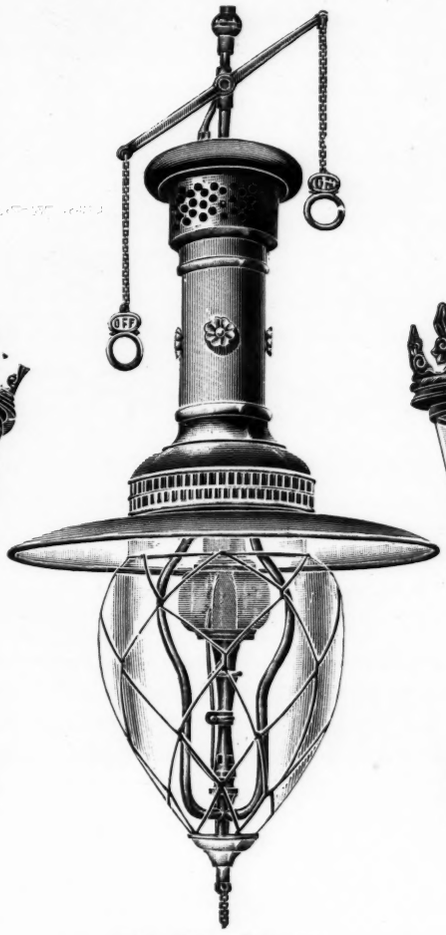

Fig. 607. 600 c.p.
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Fig. 35a. 300 c.p.
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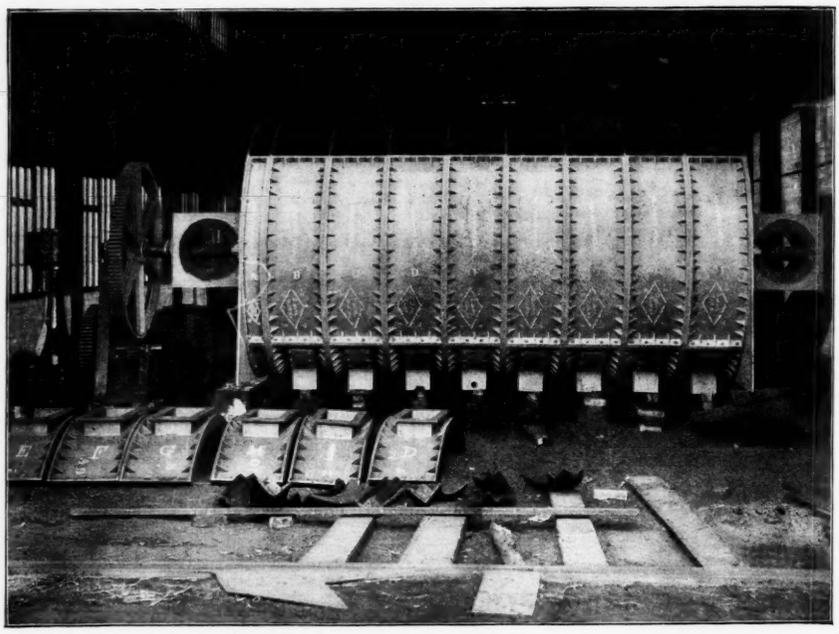

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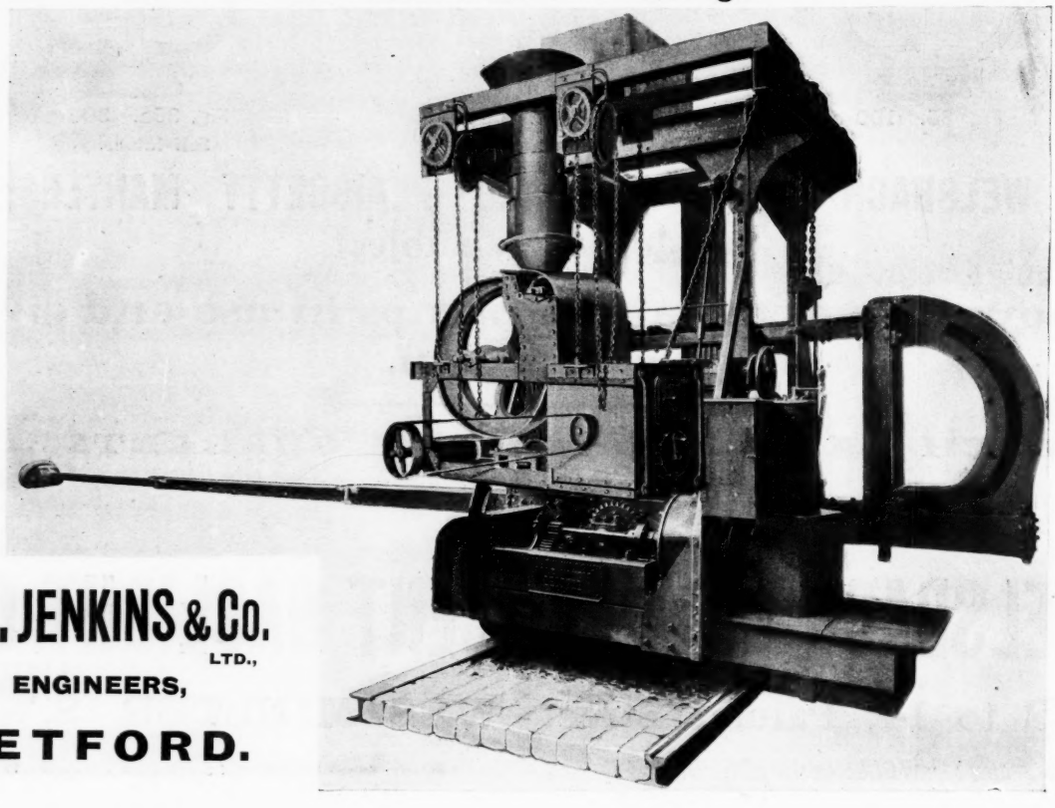
Both Discharging and Charging Operations performed by one machine, for Retorts 20 feet through.



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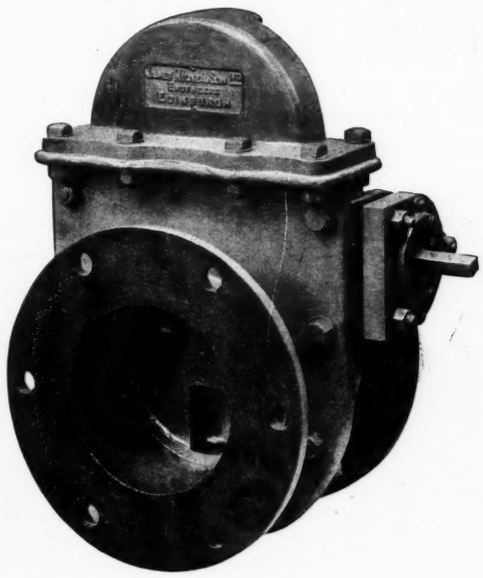

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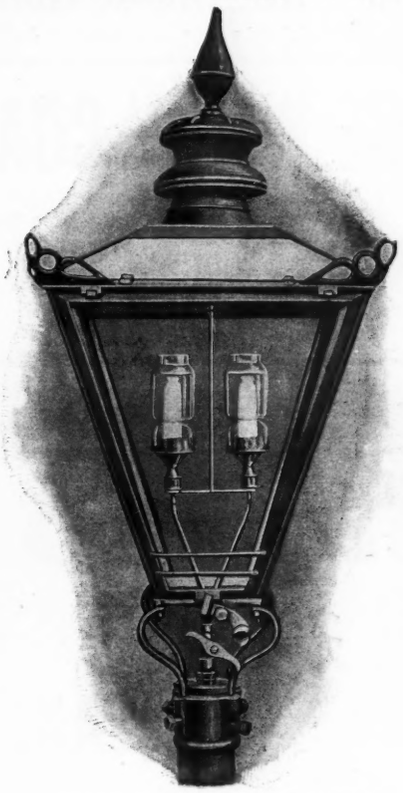

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FITTED WITH
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These Lanterns are in use in large numbers for Street Lighting in many of the principal Cities in the United Kingdom.

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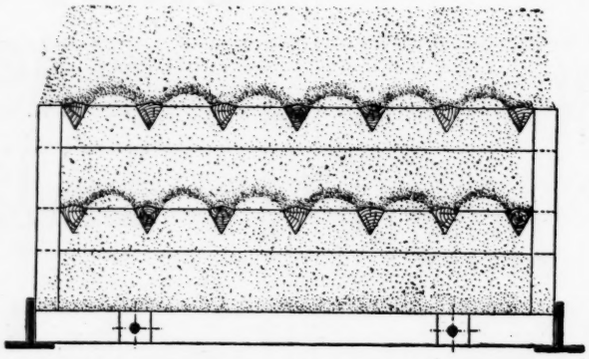

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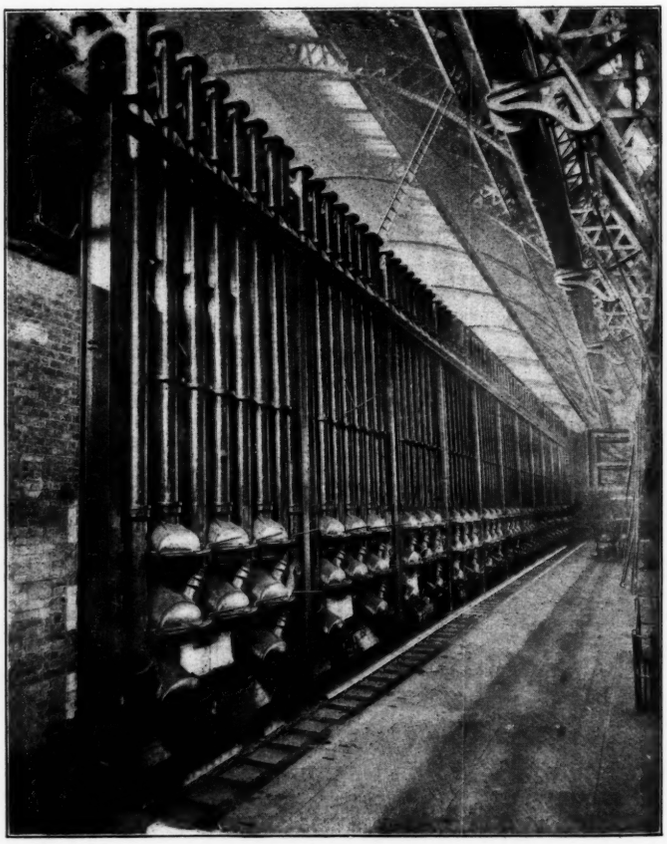

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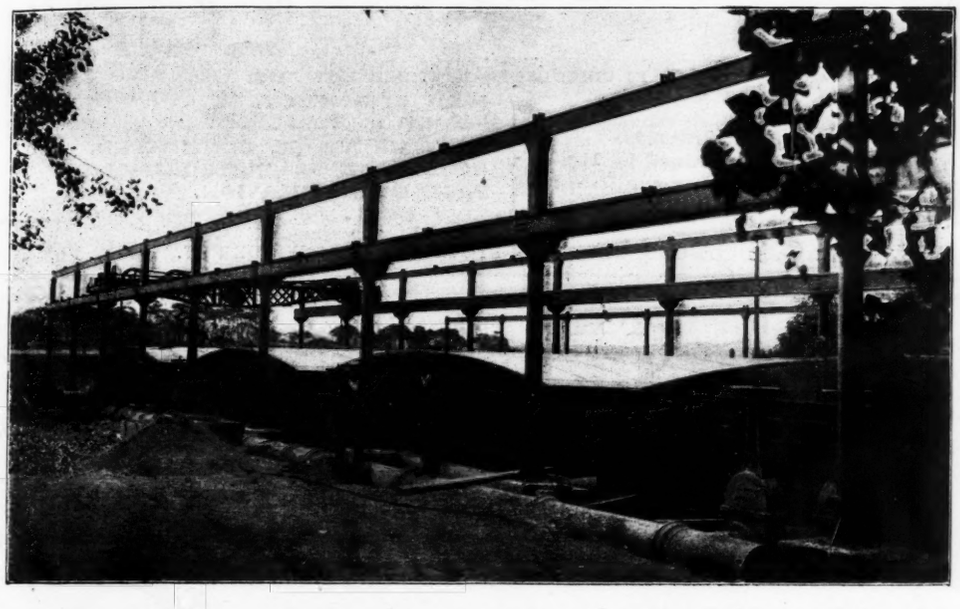

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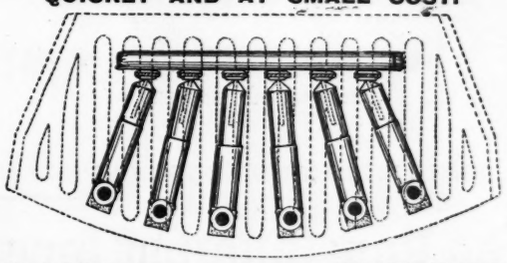

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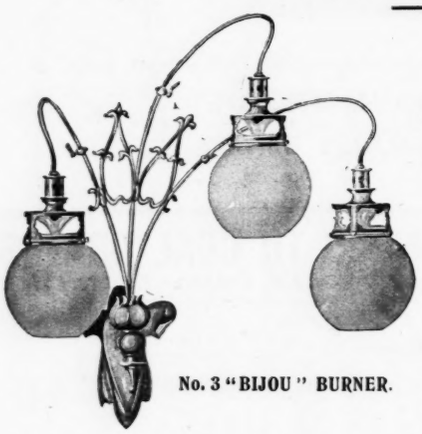

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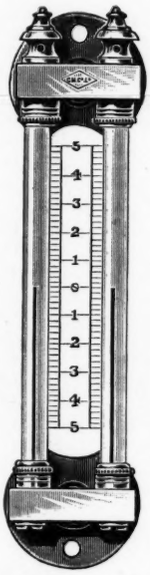

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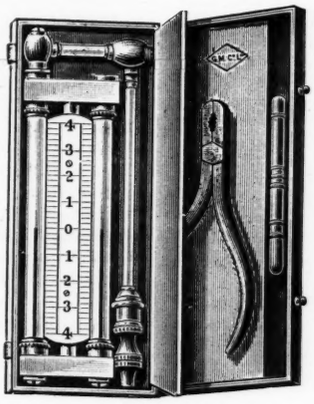

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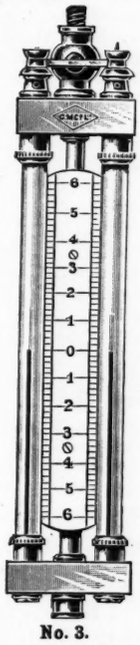

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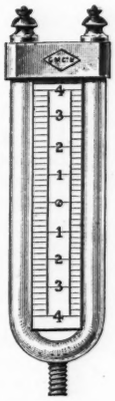

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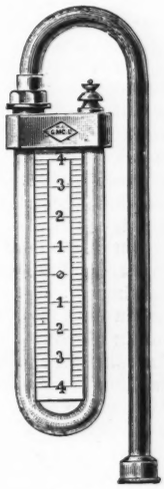

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Bordentown, N.J.	125,000	Guildford	350,000	St. Joseph, Mo.	750,000
Bournemouth	1,000,000	Hamburg, Germany	1,750,000	Santiago de Cuba	400,000
Bremen, Germany	550,000	Hartlepool	750,000	Scarborough	800,000
Bremen, Germany (Second)	950,000	Hebden Bridge	200,000	Shanghai	225,000
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Bridlington	150,000	Holyoke, Mass.	600,000	Southampton	800,000
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Brighton	1,750,000	L. & N.W. Rly., Crewe	700,000	Southgate	400,000
Brighton (Second)	1,850,000	Lawrence, Mass.	400,000	Southport	750,000
Brussels—Forest	1,000,000	Lea Bridge	350,000	Southport (Second)	900,000
Brussels—Ville	750,000	Lea Bridge (Second)	350,000	Stafford	500,000
Brussels—Ville (Second)	750,000	Liége, Belgium	1,000,000	Staines	600,000
Brussels—Ville (Third)	1,500,000	Lincoln	500,000	Stockport	600,000
Carlisle	600,000	Liverpool	3,500,000	Stockport (Second)	600,000
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Deventer, Holland (Second)	200,000	New York	1,200,000	Tottenham (Third)	350,000
Dorking	150,000	New York	4,000,000	Tottenham (Fourth)	1,000,000
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Dublin (Second)	2,000,000	North Middlesex (Second)	200,000	Utrecht, Holland	1,000,000
Dunedin, N.Z.	150,000	Norwich	1,000,000	Utrecht, Holland (Second)	1,000,000
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Epsom	225,000	Portsmouth	1,000,000	Watford (Second)	350,000
Falmouth	150,000	Posen, Germany	450,000	West Ham	1,500,000
Faversham	200,000	Posen, Germany (Second)	700,000	Winchester	225,000
		Preston	1,400,000	Zwolle, Holland	200,000

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Taunton (2nd)	350,000	West Ham (2nd)	800,000	Alkmaar, Holland	400,000
Bognor	100,000	Brieg, Silesia	100,000	Leiden, Holland	500,000
Bournemouth (2nd)	500,000	Brussels—Ville (4th)	350,000	Poole	1,500,000
Vienna	3,500,000	Innsbruck, Austria	200,000	Berlin-Rixdorf	650,000
Maastricht, Holland	200,000	Marlborough	100,000	Berlin-Charlottenburg	2,500,000
Antwerp, Belgium (2nd)	1,000,000	Flensburg, Sleswig	300,000	Bochum, Westphalia	530,000
Tottenham (5th)	1,000,000	Weston-super-Mare	300,000	Brussels—Anderlecht	350,000
The Hague, Holland (2nd)	500,000	Wexford, Ireland	100,000	Leigh, Lancs.	350,000
Hampton Court.	500,000	Budapest, Hungary	50,000	Stockport (3rd)	400,000
Lea Bridge (3rd)	400,000	Swindon.	300,000	Agram, Croatia.	200,000
Dublin (3rd).	650,000	Reading.	1,000,000	Bruges, Belgium	200,000
North Middlesex (3rd)	75,000	Oberhausen, Germany	175,000	Liége, Belgium (2nd)	750,000
St. Gallen, Switz. (2nd)	225,000	Malmo, Sweden	350,000	Lemberg, Galicia	260,000
Brussels—St. Josse	1,000,000	Ipswich.	750,000	Leeuwarden, Holland	400,000
Dundee	1,500,000	Winchester (2nd)	125,000	Stockholm	1,500,000

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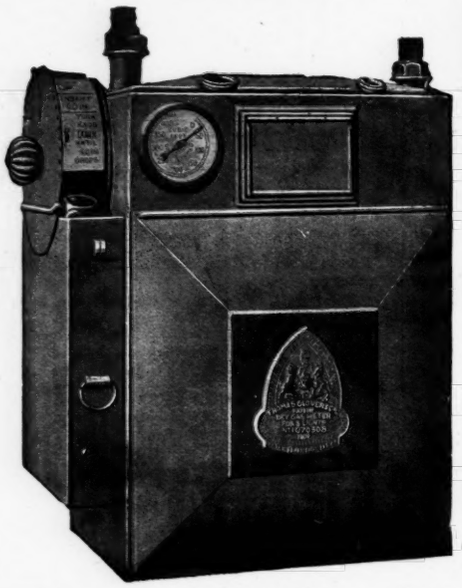

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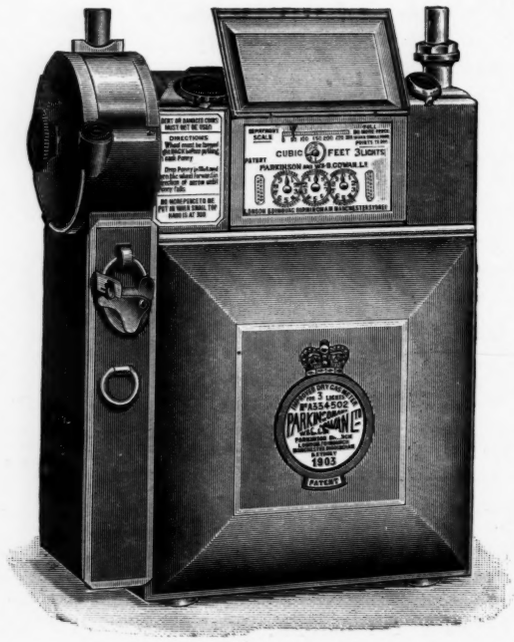

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VOL. XCII., No. 2218.—TUESDAY, NOVEMBER 14, 1905.

EDITORIAL NOTES—GAS, &c.

The Southern District Association of Gas Engineers and Managers.

THE meeting last Thursday of this flourishing Association was in every respect a success, and gave further evidence of a vitality that is most commendable. An excellent list of papers had been provided, previous to the reading of which some important formal business had to be transacted. Perhaps the most notable of this was the appointment of an Honorary Secretary in succession to Mr. J. W. Helps who, in fulfilment of the announcement made some time ago, now lays down the office which he has held, with such distinction to himself and advantage to the Association, for a period of eighteen years. Mr. A. F. Browne paid an eloquent and fully deserved tribute to the splendid services which have been rendered by Mr. Helps, not alone to the Association, but also to the Institution of Gas Engineers and the gas industry generally, especially during the last few years; and his words will be responsively echoed in a far wider circle than that to which they were addressed. His own election to the vacancy thus created is a highly popular and well-earned appointment, and can only be fittingly described as being that of the "very best" man for the post. Mr. F. W. Cross, of Lea Bridge, succeeds Mr. S. Carpenter as President, and Mr. Harold W. Woodall, of Bournemouth, was elected Vice-President. A decidedly encouraging report was presented by Mr. W. E. Price on behalf of the Naphthalene Committee—not with regard to the acquisition of funds, which unfortunately proceeds but too slowly, but from the circumstance that the Committee have succeeded in enlisting the sympathy and assistance of the Gaslight and Coke Company, who have placed the Silvertown Works at their disposal, and have met the greater part of the cost of the necessary experiments. This co-operation of so important a Company leaves but little to be desired, since their production is on so large and so varied a scale as to afford every opportunity for a thorough and exhaustive investigation of this troublesome question. It is to be hoped, however, that the powerful support which has thus been secured to the Committee will by no means divert from their coffers the much-needed contributions of those undertakings for whose benefit this inquiry has been instituted. It must be recollected that there are heavy expenses connected with it besides the adaptation of plant for the purpose; and it would be lamentable—not to say discreditable—were it now to languish for want of funds.

Of the three papers presented to the meeting, the one on "Oxide Purifying Boxes," by Mr. Norton H. Humphrys, of Salisbury, was taken first. It describes two departures from what, not many years ago, was the almost universal method of constructing purifiers and purifier connections. One of these—the luteless lid—is generally adopted for new works. The other is the system of above-ground connections, and is of comparatively recent introduction. This may almost be said to have been made possible by the first-named, which renders the entire sides of the purifier available for connections, instead of the bottom portion only, as is the case when a water-lute is employed. It is a system which undoubtedly presents some advantages. However, the very useful discussion which followed the reading of the paper, turned chiefly on the method to be followed in the construction of luteless purifiers. Opinion was pretty evenly divided between the merits respectively of small and of large covers—the advocates of the latter laying stress on the avoidance of decking, which interferes somewhat with the proper distribution of the material in places; while those who favoured small covers regard decking as an advantage in the facility it affords for filling every part of the purifier. There is, we think, an additional reason why comparatively small covers should be preferred. They can be made of much lighter material than very large ones; and the decking forms an element of strength as regards the purifier itself, which is of considerable value. We have heard of large covers which required to be bolted down in the middle as well as all round the sides; while the joist-iron suggested by Mr. J. W. Helps savours somewhat of a makeshift. Any way the discussion upon this point cannot but serve a very useful purpose by bringing into view all that can be said on both sides. On two points there was practical unanimity. It is generally conceded that the system of jointing adopted with these purifiers is satisfactory, whether india-rubber or gaskin be used; while a safety seal is admitted to be essential in the case of all purifiers, whether luteless or otherwise. This should be placed in the most convenient position for observation without risk of danger from escaping gas.

The paper by Mr. R. Herring, of Dover, on "A High-Speed "Exhauster for Pressure-Raising in Gas-Mains"—rather an unnecessarily long title, by the way—was very well received; and although the discussion soon made it apparent that the author was not the first in the field in this connection, he need not be any the less satisfied with himself on that account. He acted on his own initiative; and more could not be expected of him or of anyone else. That a blower actuated by a steam-turbine is a very handy instrument for raising pressure is abundantly clear; and that it is capable of rendering essential service in circumstances such as those related by Mr. Herring, and also by Mr. Broadberry and others, is very manifest. In point of fact, it is almost to be apprehended that the very facility of this method of raising pressure may, if reliance be placed upon it in preference to the enlargement of distributing-mains from time to time, become a source of danger to efficient distribution; seeing that, however perfect machinery may be, it is always liable to temporary derangement. There can be no simpler method of distribution than by means of gasholder pressure, although, when the distributing-mains are drawn upon to a greater extent than can be met by the lightest pressure available, the inconvenience referred to by Mr. J. W. Helps is experienced. Under ordinary conditions, the remedy is to enlarge the distributing-mains; but cases become more frequent in which this cannot be done without considerable inconvenience and cost. In such cases, the blower becomes a most useful auxiliary; and it is not necessary that this should be capable of giving a very high pressure. It is more necessary, in fact, that it should act as a bye-pass in the event of the outlet being shut down, especially for the purpose to which it is applied by Mr. Herring. Of the Provan exhauster, which has been designed for working under different conditions, more will probably be heard, since it seems not unlikely that this may prove a cheap and really efficient substitute for the ordinary forms of rotary exhauster.

The final paper was by Mr. R. M. Couper, of Brentwood, on his new works; but it did not lend itself to much discussion. It may almost be described as an endeavour to extract some amount of humour out of common-place material. Surprises, more or less unpleasant, are generally in store for those who proceed to construct works without being able to fully inform themselves of the nature of the ground on which they are to be erected; while, under ordinary circumstances, the most carefully prepared estimates are very frequently, to an extent, exceeded. Undoubtedly, this should be avoided as far as possible; but where a total expenditure for new works such as that referred to by Mr. Couper is in contemplation, there can be no necessity to pin the Engineer down to a detailed estimate, though he may rightly desire to see for his own satisfaction whether, or to what extent, this has worked out rightly. The cost of works in the aggregate should form the true test of the capability of an Engineer. Through the unusual length of the proceedings, we are compelled to postpone the publication of Mr. Couper's paper and the short discussion it evoked.

Imperial Continental Gas Association—
Vertical Retorts Unsuccessful at Mariendorf.

UNBROKEN regularity in excellence characterizes the reports that Mr. J. Horsley Palmer, as Chairman, has to present at the half-yearly meetings of the proprietors of the Imperial Continental Gas Association; but, nevertheless, in a concern of such far-reaching importance, Mr. Palmer is never, or very rarely, at a loss for subject-matter for his address which has interest both for those who constitute the proprietary and outer technical gas circles. To the latter, it would be strange indeed were it otherwise, in view of the distinguished professional men who head the work of the Association at their various stations. But on the point of the numerical and the quantitative excellence of the present report in respect of every branch of the diversified business, the peaks in progress have reached heights never attained before. The half-year's work ended with the roll of consumers totalling to nearly 316,000—an addition having been made since June 30 of last year of nearly 32,000, or 11·2 per cent. The meters number 387,565, nearly 19 per cent. of which are prepayment. But the omens are that this percentage is undergoing rapid change; for, of the increase of meters over the past twelve months, the prepayments represent 30 per cent. The increase in gas consumption, too, was about 5¾ per cent. This was good for the times; but it might have been better, notwithstanding the mild weather, if business had not been disturbed by the coal strike in Westphalia. The ill-wind produced by the strike, however, brought benefit upon coke sales; and the other residuals commanded advantageous prices. So much for the business of the half year.

The concessions of the Association are also being extended; but it is manifest, from what the Chairman had to tell the proprietors, that the notions of municipalities as to what are fair terms are also taking the same direction, with the result that the conditions are becoming more and more onerous. This is a pity; and the municipalities should be respectfully asked to remember that the more onerous they make the conditions, the greater the hardship they inflict on those of their constituents who use and who find gas a valuable servant and convenience. By the extension of the concessions, the Association, *quâ* an investing Company, only gain by the continuance it gives to their investments, and the spreading over longer periods the provision for amortization—seeing that the proprietors do not receive more in the way of dividend than is equitable for a commercial undertaking of this character. In speaking of the extensions of certain concessions on this occasion, Mr. Horsley Palmer instanced how the municipalities on the Continent cause monopoly to assist the rates. Free gas supply for the street-lamps has to be provided, and larger contributions have now to be paid to several municipalities with whom the Association have contracts. It is not a system that we can commend as an antidote to the evil of municipal trading, though the Chairman—while protesting against the increasing demands of the municipalities—holds it up as an excellent remedy, or rather as a "sounder policy." It may be so, from the point of view of the municipalities themselves, and of those who benefit without contributing anything towards the benefit, but surely of no one else.

The Chairman's protest and his advocacy cannot be made to blend. Cupidity is cumulative on the part of municipalities; and "monopoly" (if it can be so called), operating under the conditions that he described, will eventually find that the demands, unless something not apparent at the moment can be applied to absolutely define a limit, will become intolerably oppressive. We are very far from being advocates of municipal trading; but this does not interdict the holding of an opinion that direct trading with consumers must at some time produce a bound to the avarice and extravagances of a municipality, as rebellion against excesses now bids fair to do in our own country. Whereas when a municipality can inflict "onerous terms" on a trading company such as the Chairman speaks of, then the company becomes nothing better than a stalking-horse for the municipality. For, in truth, is it the company, working under such conditions who pay the contributions to the local exchequer for the privilege of trading, or is it the consumer who pays a price for the commodity regulated on ordinary business lines *plus* these contributions? A company trading in gas, electricity, or tramway conveyance, have not any real monopoly nowadays, for there are so many competing means whereby just the same ends can be attained. Therefore, for the consumer's or the user's sake, the "terms" inflicted, not upon but through those who make the necessary provision, should be lightened rather than be made heavier as time progresses. The more onerous the terms, the more onerous the tax upon the consumer or the user; for, without the terms, the less would he be called upon to pay for the commodity or service. The gas consumer, for example (using Mr. Horsley Palmer's illustration), pays his own rates and taxes; from the profits made from him the rates and taxes of the supplying company are also paid; then on top of this falls the free supply of gas to the public lamps, and further the subsidies to the municipal exchequer. It is the gas consumer who has to provide for all this; and the farther this kind of thing is carried, the wider becomes the inequality in taxation, while the gas undertaking itself is hindered in the cheapening of the price that would be of benefit to the consumer. We should be sorry indeed if industrial interests were subjected to any such "onerous" terms in this country, even as an alternative to the meddling of municipalities in affairs that do not concern them, and for the management of which their floating constitution, and their abstract and not personal concrete interest, disqualify them.

The proceedings at the meeting on this occasion were of unusual technical importance, in view of the announcement that the Chairman had to make on the subject of the trials of the Dessau form of vertical retort-setting at the Mariendorf works. In the interests of general knowledge, it was good of the Chairman, in the name of the Board, to give the gas industry so much information, and not to hide from the light what has so far proved a failure of this system for the particular purposes of the Association's large works. The Association have invariably been very successful in most of the technical research undertaken and applications at their works. In this case, the failure, to this stage, of the Dessau vertical retort system to meet the requirements at Mariendorf has, of course, only reference to trial settings, but on a sufficiently large scale to give determinate results. It is right and proper that large works, possessing staffs of the necessary ability, should, when there is anything in a system that portends success, give to it full consideration and trial, under technical surveillance, no matter what may be the issue. In a recent criticism of the Dessau vertical retort results, we showed that so far, at Dessau, with their 4-metre retorts, while (to the extent that experience has gone) a workable setting has been realized, the working results have not anything to commend them to preference when placed in comparison with what is obtained from other modern settings—both horizontal and inclined; and it was abundantly clear that, unless the Dessau system lent itself to perfect working expansion, at present at all events it could not compete with the excellent results that from the beginning have been achieved with inclined retorts at Mariendorf.

This is freely admitted in an interesting report by Mr. E. Körting, the Association's Chief Engineer at Berlin, from which report the Chairman read some instructive extracts at the meeting, and these supplement in several important particulars the report from Dessau. Mr. Horsley Palmer appeared to think highly of the Dessau system, speaking of its merits as "having been clearly proved," and as to the results being "so satisfactory." Disinterested technical opinion will apply a little qualification to these phrases; as there has been no conviction yet that the Dessau settings have anything in them that is in any way superior to what we already possess, and there is not yet any testimony on the points of durability or satisfaction that the present accomplishment of the retorts will be preserved as they advance in age. Mr. Körting fully explains the failure to the present of the vertical settings to meet the needs of Mariendorf. It is essential that a retort of at least 5 metres long should be used to vie with the late Mr. Edward Drory's inclined settings; and the 5-metre retort has in the experiments declined to submit itself yet to proper heating throughout its length. In the first place, the temperature of the retort at the top was so excessive that it had a destructive influence upon the illuminating constituents of the gas coming from the part of the charge incompletely carbonized in the lower portion of the retort. The change that was made with the view of correcting this condition of affairs, simply transferred the excessive heat from the top to the bottom of the retort, and endangered its stability there. It is not impossible to satisfactorily heat a 20-feet length of vertical

retort; but the proper heating of a 5-metre retort is not yet among the accomplishments of the Dessau setting as under trial at Mariendorf. And when (if ever) it is, the setting will have to prove a working superiority before the Association can entertain the supersession by it of their existing system of carbonization. Under these circumstances, the further extensions at Mariendorf are to set out along the path originally laid down by Mr. Drory; and this indicates some remoteness from a satisfactory end in the mind of Mr. Körting on the question of the applicability of the Dessau vertical system at the great works under his charge. On the other hand, it is equally clear—the reverses he has met with in the trials notwithstanding—that he has not as yet abandoned all hope of eventual success. Considering the length of time the experiments have been proceeding, we cannot but admire the stout-heartedness that Mr. Körting is displaying.

A Public Lighting Condition and Power Supply.

In the last published article dealing with charges for gas for power supply, we discussed the point as to the abridgment of liberty that the statutory definition of discounts imposes on gas undertakings in competing for power supply with suction and other producer gas plants and electricity; and another delimitation may now be considered. Preliminary observation may be made that the information that comes to hand points the fact that the opinion is broadening and settling that the power business must receive liberal treatment. Such treatment and freedom are correlated. Without the latter, the former cannot always be on the scale that will be effective in the interests of the concern. It may be accepted that, generally speaking, the prices of gas for lighting, cooking, and heating, give the ordinary user good value for his money. The incandescent gas-burner has been a more positive and influential factor in reducing the cost of lighting than all the labouring of years in the endeavour to diminish the cost of gas production to gain ground to the same end. The domestic branch of the business is therefore fairly safe, if not neglected. It is now this power business that is the greater problem in the competition of the times with the gas industry; and while the utmost freedom is wanted in manufacture to compete with the uncontrolled private gas-producer plant and the extraordinary liberty of town electricity supply, that freedom would be largely negatived with action retarded through the too narrow statutory fixing of the price boundary in relation to the already cheap lighting supply when big business offers.

The limitation of discounts by Parliament, and at the instance of local authorities possessing electricity undertakings, or who have them in contemplation, is not (as was contended in the article published on the 10th ult.) desirable in the interests of fair and unrestricted competition, nor should gas companies be longer hidebound by the conventional proviso in Acts of Parliament and contracts for public lighting, that the gas shall be supplied for that purpose to the local authority at the lowest price charged to "any" consumer in the area of supply. That was a legitimate condition when gas was almost exclusively used for lighting. Changing times, however, have obliterated the propriety of the condition; and, if the stipulation is continued, local authorities ought to have no difficulty in seeing it is only just that it should be so modified as to conform with the conditions that prevailed when the original agreement was made. In addition to lighting, gas has, from the small business that existed many years ago in heating and cooking, developed a large connection in those lines; and there are extensive establishments that now require special consideration if they are to adopt gas for those services. But such establishments, in the majority of districts, are not so important as the manufactories employing mechanical power; and it is these industrial establishments—in which gas has for power purposes been used hitherto to only a limited extent, or not at all—that the gas supplier now desires to capture. If, however, local authorities insist on compliance according to the letter of the condition as to the lowest price charged to any consumer, then the condition will prove another obstacle in the competition. What is wanted is modification explicitly defining the meaning of the stipulation as applying to the original conditions—that is to say, when gas was used practically for lighting only. There are, however, municipal authorities, with electric lighting undertakings, of the dog-in-the-manger type, who will not listen to reason; but we willingly believe they are not all of like class. Those who are suppliers of electricity have themselves the greatest liberty in the matter of price, for ordinary and public lighting and power supply; but the argument that the competition of their own electricity and of suction gas and other forms of gas-producing plant has altered the circumstances, and calls for concession on the part of the gas supplier, has no effect in inducing certain of them to resign any privilege they gained in previous and dissimilar times. It is inconceivable that in those cases the local authorities have not the sense to see that the claim to consideration in this respect is based on justice; and therefore the reason for their attitude must be that they are still unprepared to loosen in any way the circumscription that is a partial defence to their own business. But *per contra*—as was advanced in a previous article—restriction to such an extent in working for new business is not good for gas undertakings or the consumers they serve, and who form so large a proportion of the whole body of ratepayers.

That is the position; and this condition of the public lighting contract where it exists requires modification in the interests of the gas undertaking and of the power consumer, and it can be done without detriment to what the local authorities or the ratepayers are entitled to—keeping in view the position of the gas business when the stipulation was in the first place mutually agreed upon, and when present circumstances were not contemplated. It is the desire of gas companies to work in complete harmony with the local authorities; but where the authorities refuse to be reasonable, then the companies must, if they find the statutory or contract condition prejudicial, take steps to get it defined in accordance with what was the original intention. Where a municipal authority will not listen, Parliamentary Committees may. They at all events cannot be blind to the position, nor to the strong support that the gas company would bring to bear on their case in pointing to the freedom that the municipal electricity business enjoys in its conduct and for competitive purposes. All that is wanted is that clauses of Acts of Parliament containing the condition as to supply of gas for public lighting being "at the "lowest price charged to any consumer," should be amended by the insertion of the words after consumer "for lighting "purposes." This is not an original suggestion; but it may be useful to call attention to it just now, when consideration is being given to next session's promotions. There should be no difficulty in getting the change; and it would be in perfect accord with the meaning when the condition was instituted. The Wrexham Gas Company's Act of the past session supplies an example of this modification; and there is a proviso that, notwithstanding anything in the section, the price to be charged by the Company for public lighting shall not at any time exceed 2s. 3d. per 1000 cubic feet, unless, in the opinion of an arbitrator agreed upon between the parties, or, failing agreement, appointed by the Board of Trade, it is reasonable that the price should be increased in consequence of accidents, strikes, large increase in cost of coal, or other exceptional circumstances. The arbitrator is to fix in his award the increased price and the period during which it is to be paid. This gives to the Wrexham Gas Company that liberty which the old form of condition denies to (we think we may say) many other gas undertakings; and the administrators of those undertakings must be fully conscious of the disability it inflicts in relation to large consumptions for power and other industrial uses, and even for cooking and heating in extensive establishments. They should take steps to define the condition as above indicated.

By the limitations in regard to the illuminating quality of gas, discounts, and the open condition applying to public lighting, numerous gas companies are held back when they would press further forward in promoting the general interests and conveniences of the public—in other words, held back through the mistaken notion, fostered by municipal sophism, self-interest, and prejudice, that the gas consumers and the ratepayers are thus being protected. There may have been the semblance of reasonableness in this at one time; but there is not even that now. What is wanted, as (apart from producer gas in its various forms) the study of the charges made for electricity so plainly demonstrate, is equality in competition. In the circumstances, it is for municipalities to gracefully recede from any hard-and-fast line they may have drawn round the gas companies in their districts, and do by them what is only just and right. The companies really cannot continue to be the slaves of extinct circumstances.

Gas Companies (Removal of Sulphur Restrictions) Bill.

It is gratifying to learn that considerable interest has been manifested among the gas companies affected by the sulphur clauses in the proposal made, at the recent meeting of the Gas Companies' Protection Association, regarding the promotion of a Bill to relieve of the restriction those companies who decide to co-operate. The details connected with the promotion are shaping themselves in a satisfactory way; but we cannot too strongly insist upon the exceptional opportunity united action gives that those companies are throwing away who are content to go on as at present. As has already been pointed out, though they get the restriction removed, there is no reason why, if companies prefer lime purification, they should not continue it; but there is not one of the companies who know how soon the possession of the power to cease lime purification may be to their advantage. There are, as was stated at the meeting of the Gas Companies' Protection Association, forty-five Gas Companies whose Acts contain the sulphur clauses. Examination of these shows that two are (fortunately for themselves) subject to any variations in this respect that are made in the Metropolitan Gas Companies' Acts. So that the London Gas Act of last session relieves these two Companies from the sulphur provisions they were under up to the time of the passing of the Act. Of the remaining Companies, some thirteen are not tested; so that the clauses in their case are practically dead-letters. The Directors of some of these companies consider that their best policy is to allow the matter to continue quiescent, and therefore do not consider it desirable to join in the promotion. They, of course, are the best judges of their own position; and time will show whether their present decision has put them on the right side of the fence. Certainly, it is not the side of perfect safety; and to an outsider, it would appear that while the authorities are incurious in the matter is a particularly favourable time to attempt to shake off the obligation. The last information gathered was that eleven Companies have already determined to unite in the promotion of the Bill; and the Secretary of the Association (Mr. F. E. Cooper) is in communication with other Companies, some of whom, it is anticipated, will join in the application for relief. The Sub-Committee of the Association appointed to deal with the matter met last Thursday afternoon to settle various questions connected with the Bill; and subsequently there was a conference with representatives of several of the Companies who have already agreed to join in its promotion. Under these circumstances, there should be no further delay on the part of those concerned who have not yet finally settled whether or not they will link themselves with the promotion. Membership of the Association is not an indispensable condition to participation. This, we hope, is fully understood.

The London County Council and Electricity Supply.

As the time approaches for settling the parliamentary business for next session, the confusion that exists over the question of the electricity supply of London imposes itself more and more upon attention. There is no doubt we are in for a struggle of great severity over this matter in the ensuing session, which struggle will be made more acute by the facts that high and well-grounded opinion is altogether averse to the County Council increasing their responsibilities in the speculative manner their Highways Committee propose, and that the Borough Councils are not by any means in agreement on the point as to their further domination by the Council. In a measure, Parliament has already endorsed the views that a mistake was made in the past in splitting London up for electricity purposes into a number of districts, and that further cheapness may be gained by a great concentration of the generation of electricity. But the mistakes of the past are not to be rectified, and an all-round cheapening of the supply is not to be obtained, by any such simple expedient as giving a ruling power into the hands of any one immense body, whether that body be of municipal or private origin. The cheapening of the supply by concentration has not by any means been proved yet under the conditions now existing in London. The supplying Borough Councils, and the existing Electricity Companies are, as time passes, coming down closely to the figures put forward by the Administrative Company in Parliament last session; and the figures set out in the agreements entered into towards the close of the session are as instructive of the latter being as incapable of performing miracles as the Borough Councils and the present Companies. There will be three issues before Parliament next session. The one is whether a large part of London and the surrounding territory are to be handed over to the big Administrative Company; the second whether (and this appears to be the most sensible thing if at all necessary) the supplying authorities now in possession are to be allowed to make arrangements among themselves for generation on a large scale and supply in bulk; and the third, whether the County Council shall be allowed to over-ride the present authorities with a lavish scheme, the financial estimates attached to which bear anything but the most cheering aspect for the ratepayers.

Opposition from Within the Council.

The Highways Committee are responsible for the proposal that the Council shall go to Parliament with an immature scheme, which—if Parliament were foolish enough to adopt it—would lead the Council into no one knows what amount of responsibility and reckless expenditure in the name of the ratepayers. The proposal is to be discussed at to-day's meeting of the Council; and we hope the result will be that the scheme will be rejected, so that the existing suppliers may not be crippled by the Council when again endeavouring in Parliament to resist the Administrative Company's yoke. The recommendation that will be made by the Highways Committee will be met by two counter-motions—one referring it back for further consideration, the other will practically be a direct negative. Meantime, an important report has been issued by the Finance Committee, and signed by Lord Welby, which should give the death-blow to the indefinite proposals of the Highways Committee, or, if it does not, it will not enhance the favour of any County Council scheme in the eyes of Parliament. Any scheme of the character suggested would involve an immediate heavy capital expenditure, estimated by the Finance Committee at some £3,000,000, during the first five or six years; and this great expenditure would be unremunerative over a long period. For interest on this expenditure during the period of construction an aggregate sum of £380,000, it is calculated, would have to be expended. The provision for sinking fund would be postponed; but the ultimate debt charges are placed at £180,000 a year. On the basis of the Administrative Company's calculations, it would be necessary for the Council to sell upwards of 200 million units of electricity at an average of 0·7d. per unit, in order to realize a profit of £180,000, even if the working expenses should prove to be no higher than those estimated by the Administrative Company. This necessary output should be considered in conjunction with the fact that in 1903-4 the existing suppliers of electricity in the Metropolitan area only had a combined sale of less than 114 million units. On all points—particularly in view of the enormous capital commitments of the Council—the Finance Committee are averse to the Council extending their financial engagements during, at any rate, the next few years. In this matter, the breach between the Borough Councils and the County Council appears to be widening; and there is little probability that there will be any concerted support of the latter by the former. The Paddington Council have passed a resolution in which they express the inadvisability of the County Council exceeding their present obligations; and much the same thing was said at a recent conference of several of the supplying Borough Councils.

The Fastening of Luteless Lids.

In the discussion of Mr. Norton H. Humphry's paper at the meeting of the Southern District Association last Thursday, the speakers in the main confined themselves to the question of luteless purifiers—debating the relative merits of large and small covers, and the inconvenience and otherwise of top decking to the boxes. But Mr. J. W. Helps raised one point upon which he, and doubtless other gas engineers, would be pleased to have information both from users and manufacturers. The point is as to which is the simplest form of fastening for luteless lids. There are a number of patents out now, whereby this form of cover can be screwed down by a single motion, instead of using the commonly employed form of eye-bolt. Mr. Helps does not know which is the better; and an account of experiences with the various devices, he says, would be of great use to those who have to design boxes on this system. We shall be pleased to publish information and experiences on the subject.

Gas-Mains Not Part of a "Factory."

Suppliers of gas and water are specially interested in a case which came before the Court of Appeal on Tuesday, and a report of which will be found in another column. A navvy employed in cutting a trench for the purpose of changing one of the mains of the Dowlais Gas Company was injured in the eye by a stone; and he took proceedings in the Merthyr Tydfil County Court to recover compensation. His claim was made on the grounds, first, that the mains formed part of the gas-works, and that the whole constituted a "factory" within the meaning of the Workmen's Compensation Act, 1897; and, secondly, that at the time of the accident he was employed "about" the factory. The County Court Judge upheld the claim and awarded compensation; whereupon the Company appealed. It was contended on their behalf that the mains were no part of the factory, but merely the media by which the gas, after it had been made, was supplied to the consumers' houses; and consequently the claimant's employment was not "about" a factory. Moreover, the spot was a quarter of a mile from the works. It was submitted, on the other hand, that the gas-works were practically valueless apart from the mains, as without them the gas could not be distributed. Therefore the mains were a portion of the works, and these were a factory, "about" which the respondent was employed by reason of the contiguity of the spot at which the accident occurred to the works, by means of a continuous line of pipes. Their Lordships, however, thought the Judge in the Court below had altogether misapplied what they had said in a cited case as to the word "about." The Master of the Rolls considered it would be unduly extending the decisions of the Court of Appeal if they were to make the area of the works cover the mains; and therefore the appeal must be allowed. Lord Justice Romer expressed the same opinion. No doubt, he said, it was convenient that a gas company should supply as well as manufacture gas; but the mains did not form part of the "factory." Lord Justice Mathew concurred. He pointed out that here there were two distinct businesses which might conceivably be carried on by different people. The claimant's employment was not connected with the manufacture of gas, but with its distribution; and therefore the Act under which the claim was made did not apply. The decision is a pronouncement in the clearest possible language that the liability of gas companies under the Factory Acts is limited to the works and the manufacturing plant. As to the justice of this limitation we are not called upon to express an opinion.

A Mysterious Fault in an Electric Cable.

Reported in our "Legal Intelligence" this week is a case that is of importance to all supply authorities using the subsoil of roads for distribution purposes. It is true the parties to the action are only in a small way of business in a country township; but this does not detract from the point of the action, which was an attempt on the part of the Ingleton Electric Light and Power Company to fasten upon, and obtain damages from, the Ingleton Gas Company for an injury alleged to have been occasioned by a workman to one of their armoured cables, which had been laid without any safeguard whatever. It was admitted on both sides that the injury was caused from the outside; but the evidence with which the Electricity Company sought to bolster up their case for damages was indefinite in the extreme. It was true that in the first week in January, the Gas Company opened the road in which the cable reposes for the purpose of substituting a 2-inch for a 1-inch gas-pipe; but it was not until February that the supply of electricity was affected, and a fault in the cable was discovered, which fault the plaintiffs asserted on assumption only was made by a pick by the defendant Company's workmen in opening up the trench for the gas-pipe in January. Nearly three sittings were consumed in hearing the evidence. But there were only three or four salient facts which were bound to produce a verdict in favour of the Gas Company. For the laying of the 2-inch main, a trench only about 2 feet wide was required, and only an inch deeper than the level at which the 1-inch pipe was situated. The electric cable, the measurement of witnesses showed, was about 2 ft. 9 in. from the gas-pipe, and at a level 4 inches below it; so that it must have been in undisturbed ground over a foot from the side of the trench. No wonder that the Gas Company's workmen were able to declare on oath that they did not see the cable, and that Mr. Justice Warrington found that the "theory" of the plaintiffs was inconsistent with the facts. Even had it been proved beyond doubt that the injury had been inflicted by the Gas Company's workmen, the fact that the cable was laid in the manner that it was, without any protection or indication of its position, would surely have amounted to contributory negligence on the part of the Electric Supply Company. Witnesses deposed that they had before seen armoured cables that had been injured by picks in the opening of roads; and that was sufficient to show that the common practice of placing covering boards over cables should be a universal one. It was conclusively proved that the Gas Company did all that was possible in the way of cautioning their workmen to exercise care to avoid injury to the property of the Electricity Company; and the facts to which we have called attention are equally convincing that the workmen could not have committed the injury. The Electricity Company must therefore look elsewhere for a solution of the mystery. Meantime, they have to pay the costs of their attempt to obtain damages for the fault in their cable from a Gas Company who have been adjudged innocent of having occasioned it. It is a matter for congratulation that, with such crude laying of electric cables as at Ingleton, there has not been more trouble between electricity supply companies and other owners of subterranean property.

Gas Managers as Municipal Councillors.

In previous issues of the "JOURNAL," we have dwelt upon the utility to the general public of having a gas manager upon the local governing body. Although, of course, he cannot vote on any subject in which the undertaking with which he is connected is pecuniarily affected, his presence and influence may be the means of preventing some action which would be detrimental to the welfare of the town. We have seen only lately, at Cleethorpes, the Engineer and Manager of the Gas Company welcoming, in his capacity of Chairman of the District Council, his professional colleagues to his town, and showing them what improvements his Company are making in order that the gas consumers may be supplied at as low a figure as possible. In another column we record the election of Mr. Thomas Duxbury, of Manchester, as a member of the Town Council of Darwen, where for some time he held the position of Engineer and Manager of the gas-works. He was invited by a large number of influential burgesses to allow his name to be put forward as an Independent candidate for the representation of the West Central Ward; and, after a stiff fight, he was elected by a majority of 103. He went before the burgesses and contested the election almost entirely on the questions of electric street lighting and the transfer of the gas and water profits to the rates; and he put forward such a strong case that, although he fought the official Liberal nominee, and the whole strength of the party was brought against him, he attained his object. The case he made out was that a very small portion of the centre of the town, which had been lighted by electricity, is costing the ratepayers £700 per annum more than incandescent gas would cost, notwithstanding that the gas would be alight all night, whereas at present the lamps are turned out at midnight, and a very few small electric glow lamps have been lighted in their place. In his address, he directed attention to the fact that when there was a loss of £3799 on the gas-works in 1902, the Council voted £1000 to the rates out of the profits, and then raised the price of gas 3d. per 1000 cubic feet to make it up. He also pointed out that when the electric cables were laid, arrangements were made for the Cable Company not only to supply and lay them, but to keep them in repair for ten years. But he showed that the ten years' repairs, as well as the first cost, had been charged to capital account, and that one of the cables, consisting of 7500 yards, was completely done for, and had to be renewed in 4½ years' time. These were some of the pertinent facts which Mr. Duxbury, as a practical Engineer, was able to bring before the ratepayers; and those who gave him their suffrages will find they have selected as their representative a man who will keep a sharp look-out on the municipal expenditure.

The will of the late Mr. A. Dougall, of Argyle Lodge, Hessle, who was for 27 years Engineer and Superintendent of the British Gaslight Company's works at Hull (and whose death was noticed in the "JOURNAL" for Aug. 22), has been proved at £19,714.

ELECTRICIANS AND THE CITY LIGHTING.

THE dismay and exasperation aroused in the hearts of our electrical friends by the action of the City authorities in preferring gas to electricity for street lighting, are being most amusingly displayed in their technical organs, and week by week (as we have shown in "Electric Lighting Memoranda"), there is testimony to the alarm rightly felt in electrical circles at the breakdown which is becoming every day more apparent in the late belief on the part of the public that electricity was the rising and gas the falling industry. To that belief, sedulously fostered by municipal authorities who have rashly committed themselves to trading in electricity, the electrical industry has owed very much of its progress during the past; and now that the time is obviously fast approaching when, the glamour of novelty and mystery having worn off, the public will be ready to judge between gas and electricity strictly on their relative merits, the Electrical Press and leaders of the industry are feeling sore alarm.

This is no doubt the explanation of the fact that those who are writing on the question in the electrical journals find it difficult to refrain from distorting or suppressing the truth. Two instances of failure to overcome this difficulty are presented in recent issues of our contemporaries. The "Electrical Times," in a paragraph relating to Alderman Miller's speech the other day to the Croydon Corporation, reports the Alderman as saying: "The high-pressure gas-lamps put up in London were charged for at £15. He had been to the City and examined these gas-lamps, and he found that, if they were put 22 yards apart, they were a very efficient light; but he would ask the Council, if they had them 22 yards apart at £15 per lamp, where did the economy come in?" Now, anyone not fully *au fait* with the facts would certainly gather from this paragraph that the Alderman was speaking of the high-pressure gas-lamps recently installed by the City authorities, and would go to Queen Victoria Street to see what the Gaslight and Coke Company were supplying at £15 per lamp, and would also imagine that the distance between each lamp and its next neighbour was 22 yards, and that many more gas-lamps at £15 per annum had been installed than the number of arcs that would have given an equal light. Whereas the facts are: (1) That the lamps referred to by Alderman Miller are those in Kingsway and Aldwych—not in "the City;" (2) that if arc lamps had been adopted in those thoroughfares the same number would have been installed as that of the gas-lamps adopted, similar invitations to tender being issued to both the Gas and Electric Light Companies; (3) that the price quoted by two Electric Companies for such arcs was £27 per annum (as against £15 for gas), with an installation charge two-and-a-quarter times as great as that quoted for the gas-lamps; (4) that the lamps are, on an average, 32—not 22—yards apart; (5) that the thoroughfare in question has been deliberately lighted by the authorities in the most liberal fashion, by reason of its importance, and because they have recognized that the London standard of street lighting has long been below that of Continental cities such as Berlin, where two-burner gas-lamps are placed only 14 yards apart in the main streets; (6) that there is no street in London lit by arc lamps that can compare with Kingsway for efficiency and economy; and (7) that the high-pressure lamps in "the City," each of which, it is admitted by unbiassed observers, is fully equal to an arc lamp, only cost £12 per annum.

Then we find Mr. Sydney Dobson, of the St. James's and Pall Mall Electric Light Company, writing to the "Electrician" on the subject with an economy of facts that is not very worthy of him. He says:—

> My own Company has recently secured the renewal of its contract in the City of Westminster at the price of £17 per 10-ampere lamp per annum, in the face of the most determined effort of the Gas Company to obtain it; and we have, further, agreed to provide 900-candle power per lamp as against 700-candle power given at present. If you will apply these figures to the part of Fleet Street to which you refer, you will see that for £204 a light of 10,800-candle power would be given by electric light, as against 8000-candle power given by gas at a cost of £208.

Now, what facts has Mr. Dobson omitted? Some that are not uninteresting: (1) His Company secured the renewal of their contract by reducing their charge per lamp from £30 to £17 per annum. (2) The Gaslight and Coke Company's tender was to provide 900-candle power gas-lamps at £15 1s. per annum. (3) The Chairman of the Committee having charge of street lighting in Westminster urged the acceptance of the Gas Company's tender because his experience—a very extensive one—proved to him that gas was the better light for the streets. (4) The Gas Company's tender was declined, partly because it involved an expenditure of £10 per lamp for the alteration of the system, but mainly because the Electric Light Company, or their friends, secured the signatures of some of their principal customers in Regent Street to a petition asking for a continuance of electric light in their street; and everyone knows how easily signatures can be obtained to a petition when those signing have only heard one side of the case, and are afraid that the threatened loss of business to the Company supplying them will involve still heavier charges to them.

Why, then, since the Gas Company were willing to supply 10,800-candle power in Westminster at an annual cost of £180 12s., as against Mr. Dobson's £204, does Mr. Dobson quote the figures for Fleet Street, where the Corporation particularly desired small units of light at frequent intervals, and omit to notice the above-mentioned facts? We would like to ask Mr. Dobson another question: Is he proposing to give a light of 900-candle power, as measured by Mr. Bradley's photometer, by means of a 10-ampere lamp at the same voltage as before? If not, what will be the consumption of current per lamp per 3940 hours? and what will be his loss per lamp per annum, taking current at the price he would ordinarily quote for a load that for several hours per day comes on the top of his heavy hotel, restaurant, and club lighting load?

In the other communication printed in the "Electrician," we note with interest an admission that ordinary arc lamps are "scarcely visible in foggy weather." How often has this obvious fact been strenuously denied by advocates of electric lighting? The only other comments we need make on the letter from Messrs. Johnson and Phillips are: First, that their remarks about allowances for depreciation greatly strengthen the case for gas lighting, as it happens to be the fact that the Gas Company's quoted prices include all charges for the running, depreciation, and maintenance of all pressure-increasing apparatus where any is used. So that a considerable allowance for the depreciation of arc-lamp mechanism, &c., has, on the anthority of Messrs. Johnson and Phillips, to be added to all the fancy prices for arc lighting that are flying around, based, by the way, on 1d. per unit. Secondly, we note with interest the first admission by any of the special pleaders for arc lighting in the Electrical Press that "a more effective light diffusion is obtained from the 34 gas-standards than from 12 arc lamps." This is just what every unprejudiced person has been saying from the first moment that the 34 gas-lamps were put into lighting; and we now await with interest two things—first, an estimate of a profitable rate to charge for running 34 electric lamps 4300 hours per annum, which will give as powerful, as soft, and as well-diffused a light as that afforded by the gas-lamps (small arc lamps would certainly not fulfil these requirements); and, secondly—a reference in the Electrical Press to the high-pressure gas-lighting in Queen Victoria Street, and Lower Thames Street, instead of to the low-pressure lighting installed in Fleet Street for a special purpose. Our friends are playing the part of the silly ostrich; but the Streets Committee have their eyes above ground.

USE OF LOCOMOTIVES AND WAGGONS ON PRIVATE LINES AND SIDINGS.

Proposed Regulations.

THE attention of all concerned is strongly urged to the importance of the inquiry announced to take place at Caxton Hall, Westminster, on the 22nd inst., so as to consider the objections made to the proposed regulations framed by the Home Office in pursuance of the powers conferred upon it, under section 79 of the Factory and Workshops' Act, 1901. By this section, the use of all locomotives and waggons on lines and sidings in, or in connection with, premises under the Act is subject to regulations by the Home Office; the Secretary of State for that Department having certified this description of work as dangerous, in view of the number of accidents in the United Kingdom in connection with such use. In the circular issued by the Home Office last May, which accompanied the draft of the proposed regulations, the total number of such accidents which occurred during the years 1902 and 1903, is given as under:

Year.	Factories and Workshops.		Docks, &c.		Total.		
	Fatal.	Non-Fatal.	Fatal.	Non-Fatal.	Fatal.	Non-Fatal.	Total Non-Fatal.
1902 . .	75	403	19	95	94	499	593
1903 . .	52	442	17	76	69	518	587
—	127	845	36	171	163	1017	1180

What proportion of these accidents occurred on gas-works is not given, but will probably be found to have been inconsiderable, notwithstanding the very large amount of traffic, in coal, coke, and other materials, which has to be dealt with in connection with the manufacture of gas. While, therefore, everyone must be desirous of carrying on this traffic with as little danger as possible to life or limb, it is of the utmost importance to see that no unnecessary or pedantic restrictions are placed upon it. This is a matter that concerns not only the Metropolitan and Suburban Companies, but every other gas undertaking in the kingdom having railway connection; and it is greatly to be hoped that these will be fully represented at the forthcoming inquiry, and that they may see their way to act in conjunction with the representatives of the Metropolitan and Suburban Companies. It should be borne in mind that acquiescence by some through oversight or indifference in objectionable provisions may greatly prejudice the objections of others who see more clearly their practical disadvantage. It is satisfactory to note in this connection that the Edinburgh and Leith Gas Commissioners are to be

represented at the inquiry by Bailie Bryson, the Convenor of the Works Committee, and their Engineer, Mr. W. R. Herring. The example thus set will, it is hoped, be generally followed.

As originally drafted, the proposed regulations were of a very objectionable kind, and calculated to greatly hinder work, to the extent, in some cases, of making it almost impossible. For instance, all railway lines were included, down to those of the narrowest gauge; and no distinction was made between these and lines of the standard gauge, in regard to the distance to be observed between them or other regulations. Nor was any exception made in the case of lines or sidings not worked by mechanical power. In the circular from the Home Office, however, which announces the holding of the inquiry, it is intimated that certain modifications will be made to meet the objections which have been received from the various trades and industries concerned. These modifications make the regulations more palatable and workable; but there still remain some very objectionable features, which it should be the object of the representatives of the gas undertakings to remove. Among these are the provisions as regards what are termed level crossings, and the storage of material in close proximity to a line of railway. The latter is frequently resorted to in order to save labour in loading and unloading; and where the material—whether coal or coke—slopes away from the railway line, there cannot be any possible danger to those who have to pass alongside.

The question, however, as to what is to be regarded as a level crossing, and provided for as such, is perhaps the likeliest of all others to exercise the official—or should we say the legal?—mind. It can be safely said that there are very few gas-works in the kingdom having private sidings in which the railway lines are not habitually crossed and recrossed by workmen along almost their entire length, and with practical immunity from accident. The reason for this is that on a gas-works the moving of waggons by means of a locomotive is almost invariably done at about a walking pace, with a shunter or shunters to see that the line is clear. It is not easy to see how this system can be improved upon, or what necessity there can be for the bridges contemplated by the draft regulations, unless under exceptional circumstances. There are other provisions which are equally open to objection; but enough has probably been said to direct attention to the great importance of this matter to the gas industry of the country,

RAILWAY SIDINGS IN GAS-WORKS.

Conference of Gas Managers in Edinburgh.

On Friday last, a meeting of gas managers in Scotland, convened by Mr. W. R. Herring, the Engineer and Manager to the Edinburgh and Leith Gas Commissioners, was held, for the purpose of considering the proposed regulations for the use of locomotives and waggons on lines and sidings in connection with premises under the Factory and Workshops Act, 1901.

Mr. Herring occupied the chair and said: This meeting has been convened at the request of two or three gentlemen who have written me with regard to the proposed regulations as to the working of locomotives and waggon traffic within premises under the Factory Act. You have already been supplied with a list of the names of the parties invited to the meeting. Mr. M'Gilchrist, of Dumbarton, Mr. Waddell, of Dunfermline, and Mr. Malam, o Dumfries, have written regretting their inability to be present; and our object is now to consider in what respect the proposed regulations are likely to affect in any way the interests of our respective undertakings. I may say that we in Edinburgh are dealing quite seriously with the proposed regulations. I understand from one or two gentlemen with whom I have conferred this morning, and who are present to-day, that they have not received copies of the regulations in question. They were, as a matter of fact, sent out by the Home Office authorities under date of May 12 last, together with a covering letter explaining that they were the outcome of the Departmental Committee's inquiries on dangerous trades in 1896. They therefore drafted certain regulations relative to the use of locomotives and waggons in factories, and asked for objections to be tabled within forty days of that date; afterwards, I think, extending this time by a few days. My Commissioners tabled their objections in due course, and have more recently received a circular, under date of Oct. 27, in which it is stated that the Secretary of State will be prepared to consider certain amendments of which they give an outlined draft. These amendments are more or less important in their character; but the circular finished up by saying that the Secretary of State will be glad to consider any objections in writing with regard to the amendments mentioned above which any person affected by the regulations may in the interval before the inquiry (which is to be held on Nov. 22) desires to bring before him, and also to instruct representatives of his Department to discuss any outstanding difficulties which it is thought could be cleared up before the inquiry by informal discussion, so far as time and circumstances permit. Earlier in the same circular, however, it is stated that, as a result of the representations which he had received from the various trades and industries concerned, he has decided "that it will be possible in many respects to meet the views which have been put before him; and he is prepared to assent to modifications accordingly." The Secretary of State thinks that the form of the amendments can best be settled at the inquiry, when all parties concerned, including the representatives of workmen, will have an opportunity of expressing their views. From this it is evident that nothing is to be settled with regard to the form in which the regulations are to be cast, excepting at the inquiry, which is to be held under the presidency of Mr. Chester Jones. Now as to the regulations as drafted, some of them are of quite an unobjectionable character, and such as no doubt are in force in all works of which we have the control. They are quite reasonable for the protection of men employed about the works; but there are many of them that will involve considerable, or are calculated to involve considerable, capital expenditure—such, for instance, as the distance between a railway waggon and the side of a building or platform. There are other important points with regard to level crossings. As the regulations stand now, and even as the suggested amendments would leave them, it will practically remain in the hands of Inspectors appointed under the Act to determine whether or not the level crossings which we all have more or less are a danger to the employees or not—that is to say, they will be able to insist on our putting a bridge or constructing a subway over or under the line of sidings which the operatives have to cross in the ordinary course of their duties. In our own case, we should have to construct an innumerable number of bridges or subways; and no doubt many of your works are similarly situated. To erect a lot of bridges would not only hinder work, but put us to a great deal of expense for no possible good. If any such regulations are put into force, however, it is only fair that the Home Office should prove their necessity. What accidents have occurred, and do occur? The best plan would be to look up the record of the accidents that have occurred on our railway sidings that these regulations would probably have avoided had they have been in force. There is just one other point, and that is the fact that all gas undertakings are practically public undertakings, and in this degree are under more popular control. Whether it is a company or a corporation, they are more amenable to public opinion. Under this plea, and the fact that we already do take every possible precaution practicable, it is for us to consider whether we should not apply jointly to have gas-works excluded, as I see in the suggested amendments the Secretary of State proposes to exclude the following: (*a*) Lines or sidings of less than 3 feet gauge. (*b*) Lines or sidings not worked by mechanical power. (*c*) Quarries and private lines or sidings used in connection therewith. (*d*) Pit banks of metalliferous mines, and private lines or sidings used in connection therewith. (The pit banks of coal mines are not under the Factory Act.) (*e*) Buildings in course of construction. (Section 105 of the Act.) (*f*) Private lines connected with factories, workshops, docks, &c., so far as they are outside the factory, workshop, dock, &c., premises, and used for running purposes only. (*g*) Explosives factories and workshops. I think, perhaps, one of our suggestions should be that gas-works should be exempted altogether from these regulations. Whether it would meet with any favour is another question. The great point, of course, is, before we come to deal with the regulations individually, to consider in what way, if at all, joint action is to be taken. I think we must first satisfy ourselves that the regulations are likely to interfere with our respective interests; and, if so, there is no doubt that joint action would be much more effective than individual action in a case like this. As to the means of bringing this about, of course, we must consult our respective authorities; and this is a matter which is open to discussion. It did occur to me to just draft a communication which is perhaps a little bit before time; but I will read it now, so that you may have my views in your mind before discussing *seriatim* the proposed regulations.

FACTORY AND WORKSHOP ACT, 1901.

Regulations for Use of Locomotives and Waggons on Lines and Sidings in connection with Premises under the above Act.

At a meeting of representative Scottish gas managers held in the Board-room of the Edinburgh and Leith Corporations' Gas Commissioners, 25, Waterloo Place, on the 10th inst., the following gentlemen met to consider in what way the draft regulations issued by the Home Office were likely to affect the interests of their respective undertakings: Mr. W. R. Herring (Edinburgh), Mr. A. Wilson (represented by Mr. J. Lowe, Glasgow), Mr. A. Yuill (Dundee), Mr. S. Milne (Aberdeen), Mr. W. Ewing (Greenock), Mr. C. Fairweather (Kilmarnock), Mr. W. M'Crae (Falkirk), Mr. T. Wilson (Coatbridge), Mr. J. D. Smith (Stirling), Mr. F. Scott (Galashiels), Mr. D. Vass (Airdrie), Mr. G. R. Hislop (Paisley), Mr. R. L. Deans (Johnstone), Mr. J. Smith (Hawick), and Mr. W. B. M'Lusky (Perth). After a full consideration and discussion of the proposed eighteen regulations, it was unanimously resolved that the interests of the undertakings represented by those present were more or less seriously affected by some or other of the proposed regulations; and that some of the regulations would render the working of waggon traffic impossible in their respective works; while others were calculated to necessitate considerable structural alterations and capital expenditure in order to comply with the regulations as drafted. It was therefore resolved that these facts should be immediately brought before the notice of the various corporations or boards of directors interested, with a view to taking joint action at the forthcoming inquiry, which is to be opened in London on the 22nd inst. It was further resolved that a joint meeting of those intending to take action (when representatives of the corporations and companies concerned might also be present) should be convened for Friday, the 17th inst.

W. R. Herring, Chairman.

I proposed that a communication of this character should be addressed to the responsible authorities in each of our respective towns, in order that they may be acquainted with the fact that we have given this matter our most serious attention, and are of opinion that the interests of our respective undertakings are seriously affected by the proposed regulations. Having done this, it is the duty of our respective authorities to determine whether or not their interests are sufficiently affected to warrant their taking action and appearing at the inquiry which is shortly to take place; and the best way of determining this is for interested parties to again meet (say) in Edinburgh at an early date and determine what line of action is to be taken, either individually or jointly.

The Chairman then asked whether it was the wish of the meeting to enter into a formal discussion of the facts that had already been laid before them, or whether it was preferable to deal *seriatim* with the proposed draft regulations. The latter proposition being agreed to, the eighteen regulations proposed were then dealt with individually and formally discussed, at the conclusion of which,

Mr. Wilson (Coatbridge) said as this was a measure that would affect most of them, he thought the better way would be to let it be a joint one by the gas companies and corporations of Scotland. Let them all bear a part of the expenses.

Mr. A. YUILL (Dundee) said he had considered this, and to an extent Mr. Wilson was right; but there were difficulties in some of his suggestions, because each of them naturally was best conversant with the little things in connection with his own works. It was easier for each to instruct his Agent or Counsel than to put his different views before only one representing the whole.

Mr. S. MILNE (Aberdeen) asked if it would not meet the case if a minute of this meeting were sent to the Home Office. To employ an Agent and Counsel was a very expensive matter.

Mr. HERRING: From our point of view, I may say that Edinburgh has already tabled its objections. We have instructed our London agent to engage Junior Counsel, so that we are quite free of anything you may decide upon doing now. Personally, I think we would go before the Commission with much greater force if we went jointly as representing the gas interests of Scotland [Mr. Wilson: That is right]; and I cannot see that there would be any difficulty in instructing Counsel in the interests of each one of us, because the proceedings would have to be based on our evidence, bringing specific facts where our interests were affected by each one of the proposed regulations. We would give our evidence, and we would be cross-examined in the ordinary way. Counsel would sum up for the interests of all parties. However, it is for the meeting to decide; and what I think is our duty as responsible heads of undertakings is to first consider and satisfy ourselves whether our undertakings are affected sufficiently seriously to warrant our making a direct representation to our corporations or boards of directors, and, if so, inform them of the fact that we have had a joint meeting, and ask them to deal with it at once, and let them determine what the procedure shall be. That was my object in drafting the circular, which I thought might be the finding of the meeting. After the finding of this meeting is circulated, then those who are of opinion that their interests are affected should meet again and determine the best way to protect their interests either individually or collectively.

Mr. W. B. M'LUSKY (Perth) supported the proposal.

Mr. MILNE: Can you inform us what is being done in England?

Mr. HERRING: I am afraid I cannot.

Mr. MILNE said he took the liberty of communicating with certain undertakings. Birmingham replied that no objections had yet been lodged by them. They were perusing the objections by others, and would communicate later if necessary. Mr. Nickson, of Manchester, replied that he knew nothing of the matter referred to.

Mr. J. LOWE (Glasgow) said he could say, for Mr. Wilson, that he was quite in favour of concerted action in the matter.

Mr. HERRING: I take it that it is agreed that this circular should be sent to the proper parties. Can you fix a date for the proposed meeting? It should be next week. Will Friday the 17th do?

The matter having been agreed,

Mr. HERRING, replying to Mr. Wilson, of Coatbridge, said it was the intention of the meeting that representatives of the respective Boards of Administrators should be present to determine the line of action to be taken.

ELECTRIC LIGHTING MEMORANDA.

A Change of Opinion in Electrical Circles—A Few High-Power Centres of Light Responsible for Unequal Distribution—Electric Lamps and Fog Penetration—Tantalum and Nernst Lamps—London County Council and Electricity Loans—Initial and Repairing Costs of Electrical Cooking and Heating Appliances.

IN another column, there is an article referring to certain further statements that have been published in the "Electrician" and elsewhere regarding the City street lighting by incandescent gas-lamps, and here allusion is confined to one or two rather important matters connected with the comparative diffusive power of various lights. There are electricians who honestly confess that ordinary electric arc lamps are defective in this respect, and there are those who allow that, for uniform street lighting, the multiplication of centres of lower illuminating power than is customary with arc light is the proper thing. This is precisely what we have been contending all through; and it is a satisfaction to get this avowal from within the formerly (on this head) inexorable electrical profession. The difficulty they have how to combat is that, to obtain the better diffusion, something must be sacrificed in economy. In other words, the division of the centralized illuminating power of the old arc lamps can only be secured by a proportionately greater consumption of electricity for the illumination realized. Among the correspondents of the "Electrician" are Messrs. Johnson and Phillips; and while they limit themselves to comparisons with ordinary incandescent gas-lamps, ignoring (in regard to this particular question of light distribution) the various high-power and high-pressure gas-burners, they admit "that a more effective light diffusion is obtained from the 34 gas standards [Fleet Street] than from twelve arc lamps." This is in agreement with the view of the Electrical Engineer to the Manchester Corporation.

Messrs. Johnson and Phillips also make frank reference to the question of penetration in foggy weather, pointing out that light has less fog-penetrating power the nearer it approaches the higher vibrations of the spectra; "this accounting for ordinary arc lamps being scarcely visible in foggy weather." This is most interesting, and bears out completely what we have held for several years. Messrs. Johnson and Phillips, however, are not disinterested persons; and have their eye to business. Their interest is revealed in what succeeds. "Flame arc lamps," they say, "have a considerably more penetrating effect in fogs than incandescent gas." That is a matter on which we join issue with them from the observations made of the flame arc lamps at Blackfriars Bridge during foggy weather. The flame arc lamp is no doubt a showy source of illumination; and when several are placed close together, as is being done (to the considerable cost of the users) outside shop windows, there is an amount of illumination that is attractive only by its local dazzling nature, which almost blinds those who wish to examine the goods displayed. A rich softer light would be much more to the advantage of these shopkeepers. The distribution of the light, however, is no better than in the case of the old arc lamps. Scientific investigation has declared this, even when tested in clear weather. It is, however, when the worst atmospherical conditions prevail that the best medium of lighting is required in the public thoroughfares. Messrs. Johnson and Phillips condemn the old type of arc lamps; and we assert that, in foggy weather, all disinterested persons will agree that the flame arc lights at Blackfriars Bridge Approach look nothing better than sickly concentrated balls of fire, and bear no comparison with the high-pressure incandescent gas-lamps in Queen Victoria Street. And this verdict is given on flame arc lamps that are placed so close together—not as they would be for ordinary street illumination—that there is what Mr. Bailey, the Engineer of the City of London Electric Supply Company, terms a good deal of "mutual influence" about them. We are exceedingly grateful to Mr. Bailey for this useful term, as the lamps at the Blackfriars Bridge Approach were erected hurriedly by the Company as a desperate expedient for convincing the City Corporation that something better could be done than the Company had hitherto been doing for the City at an outrageous price. But when it comes to ordinary street lighting, there would not be such proximity of lamps that they would derive any assistance in respect of "mutual influence," and we should then have a splendid study in light and shade in our streets. We live and learn. Messrs. Johnson and Phillips, with their interest in flame arc lamps, tell us that the incandescent gas-lamps being in the direct line of vision of persons in charge of vehicular traffic, increase the liability to accidents. With the thousands upon thousands of incandescent gas-lamps in London, we fail to call to mind any accident that can be attributed to incandescent gas-lighting. The firm may enlighten us. We do wonder, however, how much greater is the liability to accident through the dazzling local light of the flame arc lamp.

To further accentuate the views of electrical people as to the poor power of distribution of the electric light, reference may be made to a circular issued by the makers of the Bastian mercury vapour lamp. Of course, in the circular, there is nothing to compare with this type of lamp; and in the condemnatory averments of these people as to all other forms of electric lamps, incandescent gas lighting is thrown in. But the visual test to be obtained in the City and most other cities and towns, is an ample refutation of their statements so far as incandescent gas lighting goes. In the mercury vapour lamp, we are told, instead of there being a bright point of light as in other arc lamps, the light is evenly diffused throughout a long length of tube, so that there is no dazzling effect. "Arc lamps, Nernst lamps, and incandescent gas mantles [the statement proceeds], all yield apparently a good light; but it is of low penetrative quality. And in the case of a street lighted with any of these lamps, there is a bright area of light close round the lamp-posts; but the space between the lamp-posts is in comparative darkness, unless the posts are closer together than can generally be managed." This is just what is done in the case of incandescent gas lighting; and the ability to do it is owing to the cheapness per point of light. We are content with this accumulation of confession on the part of electricians of the unsuitability of the high-power arc lamps to efficiently illuminate the streets. There was contemptuous declamation against the assertion to this effect that was made long ago; but the electricians then were unable to see these things as other people saw them. If the old arc lights had a poor penetrative effect in fogs, then the lower power arc lamps will not be more successful in this regard. But the specialities of one or two firms are going, we are asked to believe by those chiefly interested, to knock the old lamps into fits. We prefer our own judgment, framed from an inspection of the lamps under foggy conditions. And we still proclaim incandescent gas lighting to be the superior illuminating medium for streets.

The electrical industry does not appear to meet with any great success in obtaining a reliable lamp of greater efficiency than the old carbon filament incandescent lamps. They get greater efficiency, but not any greater reliability. The new lamps are most erratic; and all the conditions of use must be favourable and constant, or there is shocking misbehaviour. There were great things expected of the tantalum lamp, born of the fervency of the reports made, on experiments conducted under kindly disposed laboratory circumstances, in the early days of the lamp on the market. Not until after many "hundreds of thousands" of the lamps had been sold, did Messrs. Siemens Bros. and Co., Limited, publicly state what users had been learning by bitter experience—that, when used on alternating-current circuits, the results were not so good as on continuous-current circuits. The life of the lamp frequently was considerably shortened, and the globe showed a tendency to blacken. They therefore advocated —"hundreds of thousands" of the lamps having been disposed of—that their use should be restricted, as far as possible, to continuous-current circuits. This is not very comforting to those who had been looking hopefully to aid, under all circumstances, from the tantalum lamp. From another source, we also learn that

though, under laboratory conditions, many tantalum lamps have a long life, after the first breakage of the filament, breakages become more and more frequent. Nernst lamps and osmium lamps have also their drawbacks, as has been shown on former occasions. Mention of the former is again made because, in a peculiar article in the "Electrical Review" just recently, these words appear: "For each 4 feet mantle, we would use a ½ ampere Nernst lamp, which will give about 70-candle power when new. *This lamp also falls off in candle power;* but at its lowest ebb, it is not so bad as an old mantle, and vastly better than a damaged one." That is not saying much for the Nernst lamp. The falling off in candle power is only one of the troubles of the Nernst lamp; another is that the replacement of "old" and "damaged" gas mantles is not such a costly process as the renewal of a Nernst lamp. Incandescent gas lighting is not only cheap in respect of illumination, but the cost of renewals is also an inconsiderable matter. Therefore old and damaged mantles are not used, other than by people who are not remarkable for intelligence.

Comment was made last week on the uncertainty that surrounds the future of electricity supply in London, and on the scramble that is going to be made again in Parliament in the next session for the rights of power and bulk supply. Committees of the London County Council, it was also stated, are proposing that that body should be among the applicants for the premier position in electricity supply; and they are very solicitous that the Borough Councils should not (like wayward children) take an independent course, but should give support to a body who do not appear to be capable of making a commercial success of anything. If a section of the County Council cannot get the Borough Councils on bended knee by fair means, then they are quite prepared to do so as far as possible by other means. A very effective weapon for the purpose is the refusal of loans for capital expenditure. Of course, the members we have in view will say that such a thing is altogether foreign to their thoughts, and that they are protecting the Borough Councils against their own foolishness, and, as quite an incidental thing, are trying to retain for the Council good business openings for that great day when they shall be able to supply the boroughs in bulk at prices almost undreamed of. Supposing, however, the Council are not successful in getting plenary electricity powers from Parliament, the delay that they have it within their possession to inflict on the Borough Councils may be to the advantage of the Administrative Company. The Fulham Borough Council have been pulled up by the County Council, on asking for a loan of £25,000 which is required in connection with an extension scheme estimated to cost £67,328. What has happened in this case shows variable winds. The Finance Committee of the County Council first approached the Fulham Council, pointing out that the present, in view of recent events in Parliament, was a most inopportune time for largely increasing the plant. On learning, however, that the work had already been commenced, and the money partly expended (after the common practice of municipal bodies), the Committee recommended the granting of the application. The Council, however, postponed the further consideration of the question of their sanction. The County Council is a wary bird in some things, but not in all. The caution displayed on this occasion indicates as plainly as possible that the view in Spring Gardens at first was that the development of the electricity business ought to be stopped, in order that the Council—the chances are greatly against them—might gain. After a little rest, however, the Council, at their meeting last week, much against the will of a not insignificant number, granted the loan to Fulham; the Borough Council having convinced the Finance Committee of the County Council that the plant was absolutely necessary to meet the maximum demands this winter.

Anyone who had an opportunity of examining the complicated, and in some cases crude, arrangements for cooking by electricity exhibited with the most immodest presumption at Olympia, will have done so with a feeling that, even with electricity at 1d. per unit, the use of such apparatus would be attended with other considerable expense. A penny per unit for cooking and heating is a price that is only found in particularly favoured districts, and the service rendered is costly at that. Mr. Dowsing, who is a manufacturer of electrical heating and cooking stoves, in his lecture on the subject at Olympia, accused the suppliers of electricity of being the cause of the backwardness of the particular branch of the electricity industry in which he trades; and there are other makers of like opinion. On the other hand, there are electrical journals and managers of electricity supply who declare that the character and price of the cooking and heating apparatus are alone to blame for the want of popularity. Examination of the apparatus and comparative calculations of cost as given when members of the daily Press were charmed into laureating the electrical cooker by partaking of a dinner prepared by its means induce a very confident opinion that both the makers and the electricity suppliers are right. Than this, nothing could be fairer to both parties. However, Mr. Dowsing, because a few undertakings in London have dropped to 1d. per unit for cooking and heating, seemed almost on the verge of ecstasy in anticipating that the majority of supply undertakings would follow suit. But all electricity undertakings are not going to do this until they are assured of substantial, remunerative, and a not too troublesome business, through the electrical apparatus being of a dependable character, and not too expensive in respect of the initial, maintenance, and working costs. If there is not economy in electrical cooking and heating, it will not do the lighting business much good; and lighting consumers are forsooth finding some unconscionably heavy accounts in comparison with the incandescent system of gas lighting. A correspondent of the "Electrical Review" exhorts the Editor not to believe Mr. Dowsing's assertion that the supply authorities are at fault in retarding electric cooking and heating. This correspondent writes pithily; but in their very pithiness his sentences are keenly effective. "Who," he asks, "can afford to fit up a kitchen when the cheapest kettle on the market is listed at 24s.?" Then he goes for Mr. Dowsing's own products by inquiring, "Who can afford electric radiators at £4 4s.?" He replies, "Very few can, and will, do this." Then on the subject of repairs, he asserts that this is also a heavy item. He bemoans his fate in having recently had to pay 10s. for repairing an electric kettle. A few new kettles of quite decent appearance and strength can be purchased for gas-stove use for the sum required to repair this one electric kettle. Then, we learn from this truthful correspondent, that to replace a lamp in a radiator costs 5s. He gives list prices; and these are what the consumer has to pay. It is truly interesting and useful to hear all sides on these matters. It is evident that the application of the bunsen gas-burner for cooking, heating, and lighting is more economical for consumers in first cost and in maintenance than anything the electrician can offer.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 496.)

THE Stock Exchange has had a fairly calm week, but the tone was apt to vary from day to day. After a dullish opening, things began to improve. The better class investments hardened, and Home Rails improved on their already solid advances. But by mid-week a change took place, and a good bit of French selling made the tone lower. Thenceforward things ruled rather quiet and dull; but at the close they were looking better again. In the Money Market there was an ample supply to meet all short loan requirements; and discount rates were steady. In the Gas Market, the aggregate of business done was about a moderate average, though one or two days were rather quiet. The tendency was quite favourable, and several quotations had more or less considerable rises. And it was noticeable that one or two issues which had recently been showing weakness now quite reinstated themselves in their old situations. Gas stocks, as a class of investment, are decidedly holding a firmer position in public favour—thanks in no small measure to recent achievements of the illuminant in streets, railway termini, and other public places where people can see for themselves what it can do. In Gaslight and Coke issues, the ordinary was active and buoyant; and the quotation closed higher. Transactions marked were at prices ranging from 99⅝ to 100¾; the final bargain being the best. Business was more active in the secured issues. The maximum was done at from 89½ to 90¾; and the quotation was put down on Friday and up again on Saturday. The preference changed hands at from 111 to 113; and the debenture at from 87 to 87½. South Metropolitan was much more lively, and had an advance of three points. Transactions ranged from 128½ to 131. One deal was done in the debenture at 87½. Commercials were quiet and unchanged. The 4 per cent. was done at 115½ and 116¾; the 3½ per cent., at 112½. Very little business was done in the Suburban and Provincial group. Alliance and Dublin changed hands at from 21½ to 22, Bournemouth "B" at 17⅛, and Lea Bridge at 126¾, which put the quotation up a point. South Suburban marked 124½, West Ham ordinary 105¼ to 106, and ditto preference 124½. Of the Continental Companies, Union was the most active, and had a smart rise. The ordinary was done at from 118½ to 122½; the preference was not dealt in. Imperial rose a point, changing hands at from 219½ to 220½. European fully-paid marked 22; and ditto part-paid 15. Tuscan was done at 9⅞ and 9 15/16. Among the undertakings of the remoter world, Oriental was done at 150¼ and 150¾, with a rise of three points, Cape Town at 17¼ and 17⅜, Monte Video at 12½ and 12¾, and San Paulo at 13¼ and 12⅜. River Plate changed hands at 12⅞ and 13⅛, Primitiva ordinary at from 6¾ to 6 15/16, ditto preference at from 5⅜ to 5¼, with a fall in the quotation, and ditto debenture at from 98½ to 98⅞.

The closing prices are shown in our Stock and Share List on page 496.

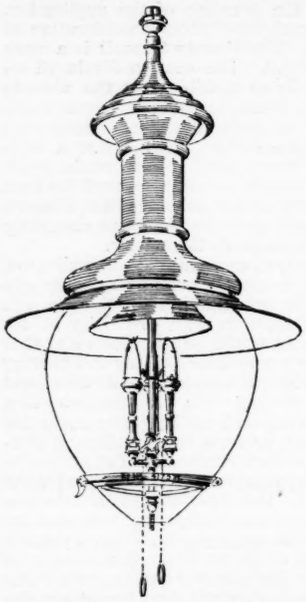
Association of Foreign Municipal and Sanitary Engineers.—Reference has already been made in the "JOURNAL" to the formation of an Association of Foreign Municipal and Sanitary Engineers, Architects, &c., with the object of bringing them into closer connection with each other, and for the discussion of questions of special interest. The first meeting is to be held in Paris from the 22nd to the 25th inst. Among the subjects to be brought forward are the filtration of water and afforestation in connection with rainfall. Visits will be paid to the filter-beds of the Municipality at Ivry and those of the Paris Suburban Water Company at Suresnes. The last day of the meeting will be devoted to a visit, under the guidance of the Engineers of the City of Paris, to the water-intakes on the Loing and Lunain.

THE LIGHTING OF A LONDON RAILWAY STATION BY GAS.

A Night View along the Circulating Area Leading to the Platforms.

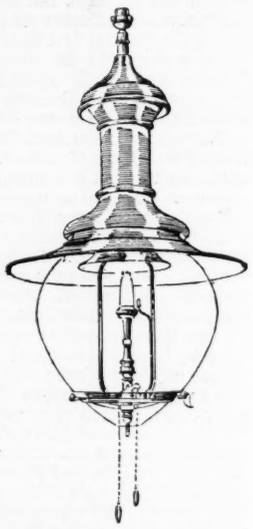
The Gaslight and Coke Company must now be accounted as quite expert on the subject of railway station lighting by modern methods. They have achieved some remarkable successes in this direction. It was a terrible disappointment to the electrical folk when, although the electricity was privately generated, the lighting of the old Victoria Station of the London, Brighton, and South Coast Railway fell into the hands of the Gaslight Company. Still keener was the disappointment when the Company, competing with electricity at a finely cut price, got the contract for lighting the new Victoria Station; and there must be great heart-burning over the fact that the Company have again scored a success at such an important terminus as the Broad Street Station of the North London Railway, when electricity could be bought, or at any rate generated, at so low a figure as 1¼d. per unit. With all respect to the North London Railway authorities, we must say that it was about time the lighting of the station was improved; the previous lighting being solely by old-fashioned flat-flame gas-burners. But delay has had this advantage, that the Company have had before them the choicest systems—both electricity and gas—for their special purpose that could be submitted to them, as well as the experience in other quarters of not a day but of great length, under all the changeable atmospherical conditions and the severities—steam, dust, smoke, and shock—to which lights of all kinds are subjected in railway stations, more especially in those that are covered. Under these circumstances, the North London Company's choice for the lighting of the Broad Street Station is the result of ample deliberation, through which has no doubt run the influence of the fact that at Victoria Station the Brighton Company have saved over £1000 per annum by substituting good gas lighting for indifferent electric lighting. The preference has been for high-pressure gas lighting; and last Tuesday witnessed the bringing of the new system into use, and the final conversion of the large station from a place of gloom into one giving representation to the acme of lighting for such a purpose. There is no place where greater protection is required for the public safety than in a railway station; and agreement in this statement only requires consideration of the dangers that beset the traveller in an ill-lighted but much patronized station during the busy hours. Here we have in the lighting of Broad Street Station a perfect model of what the illumination should be. There is effulgence; but the eye is not irritated, nor does it receive any distressing shocks such as one gets with the open arc electric lights at Paddington Station. There are no shadows. Every obstacle is well outlined; and the edges of the platforms are clearly defined. The officials of the Company, too, are greatly assisted in their duties, especially when inspecting tickets.

All the lighting, other than in the offices, is by the high-pressure system; the total number of high-pressure lamps employed in the work being 110. For the lighting of the eight long platforms, the circulating area to the platforms, the five staircases, and the carriage approach, Messrs. William Sugg and Co.'s 300-candle power "Newark" lamps (as illustrated) are employed; while the two arcades are each illuminated by two of the firm's 1000-candle power "Belgravia" lamps. Photographs, taken at night-time (two of which we reproduce), clearly show the beauty of the



The Thousand Candle Power "Belgravia" Lamp.

[Two of these are fixed in each Arcade.]



The Three Hundred Candle Power "Newark" Lamp.

[Used on the Platforms, Staircases, and Carriage Approach.]

lighting, though the reproduction has caused the clearness of the photograph to suffer somewhat.

To go into the lighting with a little more detail, the eight platforms (two of which are island ones) are lighted with 59 of the "Newark" 300-candle power lamps; supported on columns about 12 feet high, excepting on the side platforms, where they are carried on brackets. The lamps are spaced about 36 feet apart; and the columns and brackets upon which the lanterns are mounted are some 12 feet high. The total illuminating power of the 59 lamps is equal to 17,700 candles, with a gas consumption of about 590 cubic feet. Thus the gas for the lighting of the whole of the eight platforms only costs 1s. 8½d. an hour, with gas at 2s. 11d. per 1000 cubic feet. Walking along the platforms at night-time is quite a pleasure; but the contrast is great indeed when one gets to the end and looks into the gloom beyond, where a few flat-flame lamps are still making the best of existence in face of lost reputations. Turning to the carriage approach, the five staircases, the two arcades, and the circulating area leading to the platforms, the same excellence is found. Altogether in these situations are 51 Sugg high-pressure lamps; and their total illuminating power (including the 1000-candle power lamps previously referred to) is 17,260 candles, with an hourly consumption of 576 cubic feet of gas, costing only 1s. 8d. per hour. These are figures for railway authorities to ponder over. The gas supplied to these lamps is taken direct from one of the Gaslight and Coke Company's high-pressure mains, in which the pressures vary, according to the draught, anywhere between 12 and 20 inches. For this reason, governors are fixed at the inlet of the two 300-light dry meters (by Messrs. George Glover and Co., Limited) at the station, and regulate the pressure for the lamps to 10 inches. The constancy of the illumination shows the regularity of the supply conditions; there being an entire absence of the jerkiness

A Night View Along the Island Platforms.

and fluctuation that are so annoyingly frequent in the case of electric arc lamps. While high-pressure lighting monopolizes all the important parts of the station, there are in the parcels office, cloak room, booking-office, &c., ordinary low-pressure incandescent lamps, giving a light equal to 5040 candles for a consumption of 252 cubic feet—costing a fraction under 9d. per hour.

Now what does this all mean for the Railway Company—and the public? For the former, a money saving and one of the best lighted of London railway termini; and for the latter, protection and comfort. For, regarding the statement as to saving, we have seen that the whole station is lighted upon a consumption of gas not exceeding 1450 cubic feet per hour; so that the cost for gas is just over 4s. an hour. We have no doubt the Railway Company are allowed a small discount owing to the magnitude of their account; so that there would be a little reduction here. Then upon the gas account comes the charge for maintenance, which will amount to about £70 a year. In the old days there was a considerable and wasteful consumption of gas going on, to obtain the best efficiency by effete means. Owing to this, it is estimated that the gas bill will be reduced by more than £200 a year, after providing for the cost of all mantles, attendance, &c.; while the illuminating power within the station is increased from 8000 candles to a total of 40,000 candles! Then congratulations to the Railway Company and their Locomotive Superintendent (Mr. Henry J. Pryce), to the Gaslight and Coke Company and their Chief Inspector (Mr. F. W. Goodenough), and to Messrs. William Sugg and Co., Limited, who were the fortunate recipients of the contract for the installation. Remember that in this case incandescent gas lighting won favour with electricity competing at the low price of 1¼d. per unit.

Prizes of the Royal Scottish Society of Arts.—The Committee of this Society of Arts have awarded prizes for communications made during last winter's session, as follows: To Mr. H. O'Connor, Assoc.M.Inst.C.E., of Edinburgh, for papers on "A Flash-Lighter for Incandescent Gas-Lighted Lanterns" and "A Simple Apparatus for the Detection of Carbonic Acid and Other Gases," a Keith Prize, value £5; and to Mr. Daniel Macfie, for a paper on "A Gas Meter and Governor in Combination," a Reid and Auld Prize, value £3. All the papers were read before the Society on Monday, Feb. 27; and descriptions of the apparatus were given in the "Journal" for March 7, p. 641.

Preservation of Iron and Steel Surfaces.—At the meeting of the Society of Engineers, at the Royal United Service Institution, on Monday last week, a paper was read on "The Metallic Preservation and Ornamentation of Iron and Steel Surfaces," by Mr. Sherard Cowper-Coles, Assoc.M.Inst.C.E., &c. The author first referred to the theory of protective metallic coatings for iron and steel, and gave examples of corrosion caused by two metals being in contact in the presence of moisture. He then described the process of hot galvanizing, or dipping in molten zinc, and some special forms of apparatus employed for the galvanizing of sheets and wire. The next process referred to was cold galvanizing, which consists of electro-depositing zinc from aqueous solutions. The greater portion of the paper was devoted to a new process of dry galvanizing, or "Sherardizing," discovered by the author. A remarkable feature of this process is that iron and steel can be coated with metallic zinc by merely bedding it in zinc dust in a drum, placing it in a furnace, and raising the zinc to a temperature several hundred degrees below the melting-point of the metal. A number of specimens were exhibited, showing the application of the process to all classes of iron to render it non-corrosive. The process is found specially suitable for coating bolts and nuts, as the zinc is evenly distributed so that the threads do not require re-cutting.

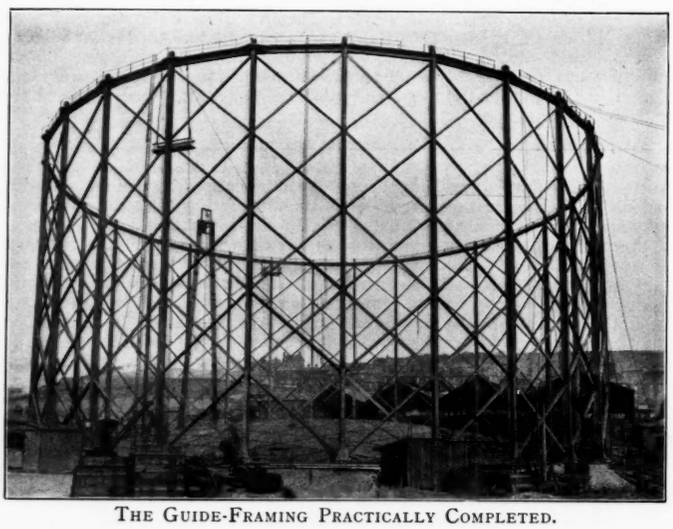
THE NEW HOLDER FOR THE NEEPSEND GAS-WORKS, SHEFFIELD.

THE THREE GRIPS AND STRONG CURB-PLATE.

THE supplement to this week's "JOURNAL" shows the side sheets and cup carriages of the holder. The outer lift consists of a bottom curb of two rings of 7 inch by 3½ inch by ½ inch angle steel and one plate ½ inch thick. Each length of plate extends the full distance between the vertical guides, and has joint-covers 2 ft. 6 in. long and ½ inch thick. The plates are 12 inches minimum width, with their outer edge cut to a curve, the radius of the holder. The curb side-plates are 2 ft. 3 in. deep and ⅜ inch thick, with sheets of No. 9 N.S.W.G. adjoining, followed by ten rows of No. 11 N.S.W.G. sheets 3 ft. 2¾ in. deep on rivet centres. The grip is formed of one-hundred-and-twelve ⅜ inch bent plates, 1 ft. 9 in. deep, 10½ inches wide, with 3 inch by ⅝ inch bead on the inside. It has a wrought-iron rest-block secured to the crown of each plate. The outer edge of the grip extends 2 feet down the sides, and is rivetted to a No. 9 N.S.W.G. sheet, above the intermediate sheets. Opposite and intermediate with the guide-framing, ¼ inch vertical strips, 1 ft. 6 in. wide, extend the full depth between the curb and grip plates, and are butt-jointed thereto, with lap joints to the side sheets. On the outer side of these ¼ inch strips are two 4 inch by 3 inch by ½ inch channel steels, fixed 6 inches apart, back-to-back; and on the inside is a 6 inch by 3 inch by ½ inch steel channel to form a path for the cup-carriage rollers of the third lift, with angles on each flange, for their full length, secured to the strip plates by ¾ inch bolts, 12 inch pitch.

The third lift consists of a cup and grip, 10¼ inches wide by 1 ft. 9 in. deep, of ⅜ inch and 7/16 inch plates respectively, with No. 9 N.S.W.G. sheets adjoining, and ten intermediate rows of No. 11 N.S.W.G. sheets, each 3 ft. 3 in. deep, and having ¼ inch vertical strips, 1 ft. 6 in. wide, with two 3 inch by 3 inch by ½ inch channel steels 6 inches apart, back-to-back, on the outer side, and 6 inch by 3 inch by ½ inch channel steels on the inside, as guides for the carriage rollers on the second lift, secured by ¾ inch bolts, 12 inch pitch.

The second lift is constructed similarly to the third, but the cup is formed of 7/16 inch plate and the grips of ½ inch plate.

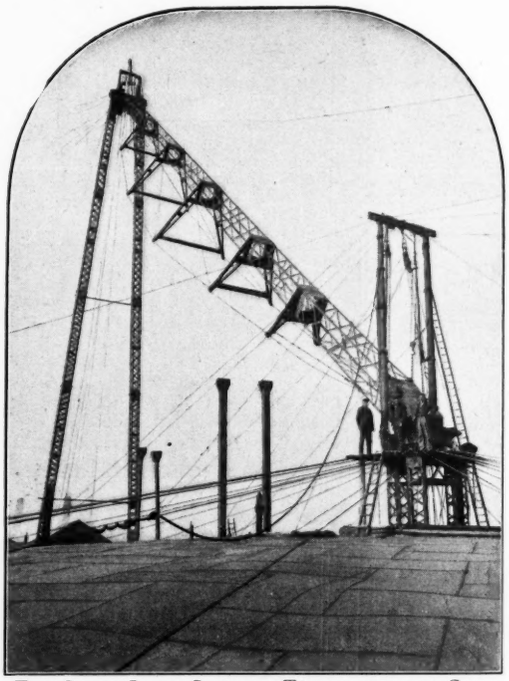


THE GUIDE-FRAMING PRACTICALLY COMPLETED.

The inner lift is made up of ½ inch cup plates, 1 ft. 9 in. deep by 10¼ inches wide. There are one-hundred-and-twelve plates in the circumference. The plates are 2 ft. 3 in. deep next to the side of the holder, and joined to No. 9 N.S.W.G. sheets (as in other lifts), followed by ten rows of No. 10 N.S.W.G. and ¼ inch vertical strips, 18 inches wide.

The top curb is formed of one 6 inch by 6 inch by ⅞ inch angle steel, opened out to agree with the radius of the crown. It is 239 ft. 1 in. diameter, in twenty-eight lengths, machined at the ends and joined together by round-backed angle covers, ⅞ inch thick, 2 ft. 6 in. long. The side curb plate is ⅞ inch thick, by 1 ft. 5⅜ in. wide, and fixed vertically to the angle curb by rivets 1⅛ inches diameter at 3⅜ inch diagonal pitch. The ends of the curb plates are machined perfectly true, and covered by double joint-covers ⅝ inch thick by 9 inches wide; the lower edge being secured to a ½ inch plate 1 ft. 8¼ in. wide, with ends lap-jointed, and with ⅜ inch rivets, 2¼ inch pitch. The plates are joined on the lower edge to the No. 9 N.S.W.G. sheets in the side sheets by ⅝ inch rivets, 1⅞ inch pitch.

On the inside of the holder is a bent steel-plate boom-stay, 15 inches deep by 9½ inches wide, constructed as shown, and secured to the side sheets and crown. The top and bottom plates are ¼ inch thick; and the intermediate ones, 3/16 inch thick. The lower



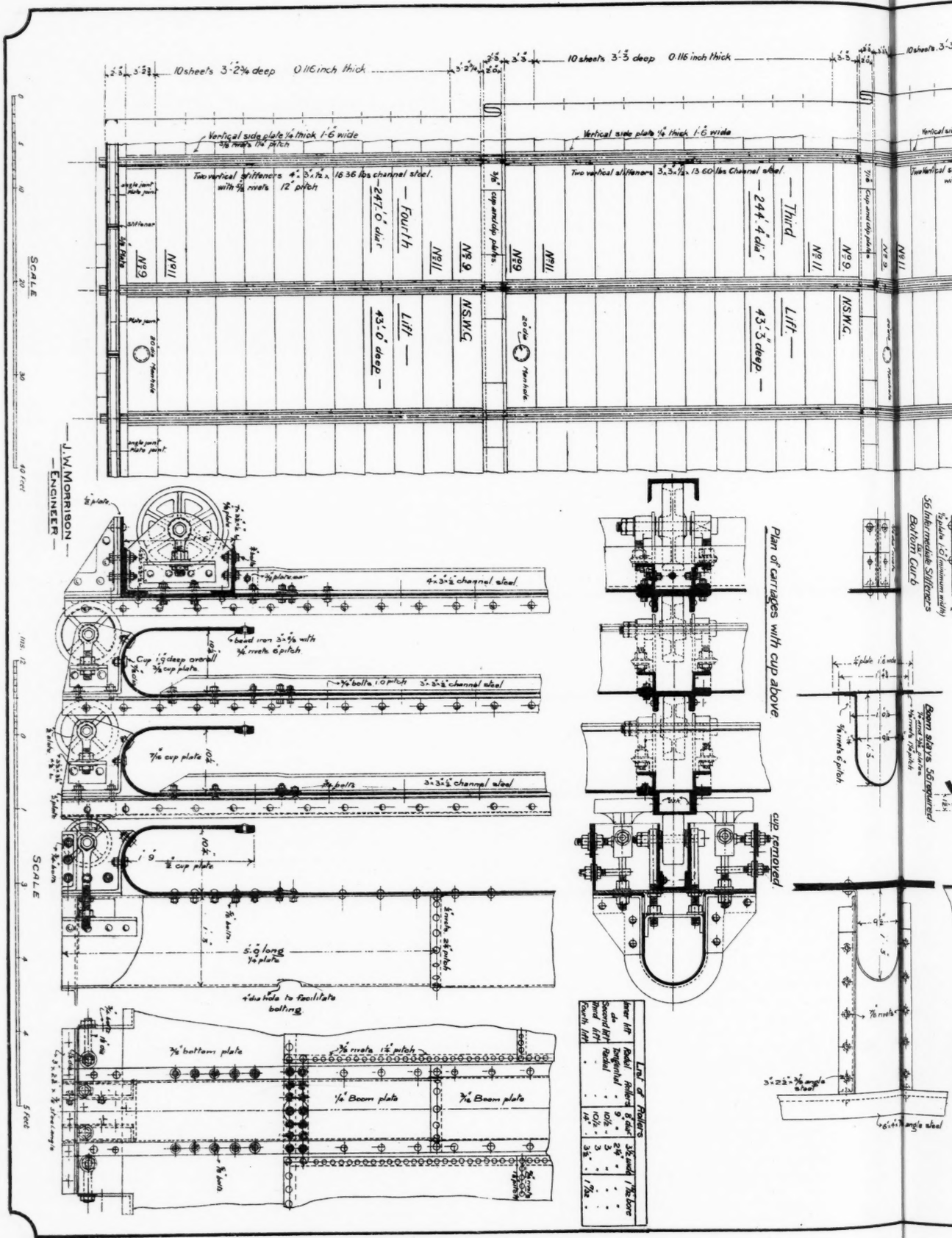
THE SHEER-LEGS, SUPPORT, TURNTABLE, AND GUY-ROPES USED FOR ERECTING THE FRAMEWORK.

end extends down below the cup, so as to form a backing for the cup carriages. The upper end is provided with double gusset-plates ¼ inch thick, diagonally-braced by 2½ inch by ⅜ inch flats, and secured to the crown curb plate by 3 inch by 2½ inch by ⅜ inch angle-steels.

Fifty-six guide carriages are attached to the bottom of each lift. The cup of the inner lift is, in addition, provided with both radial and tangential rollers. All the cup carriages are secured to the holder by ⅞ inch diameter, specially curved, hexagonal bolts, with felt washers. The rollers are of cast steel, machined on their faces, and bored to suit the bolts. All bolts on which the rollers revolve have square necks and double nuts, so as to prevent them working loose.

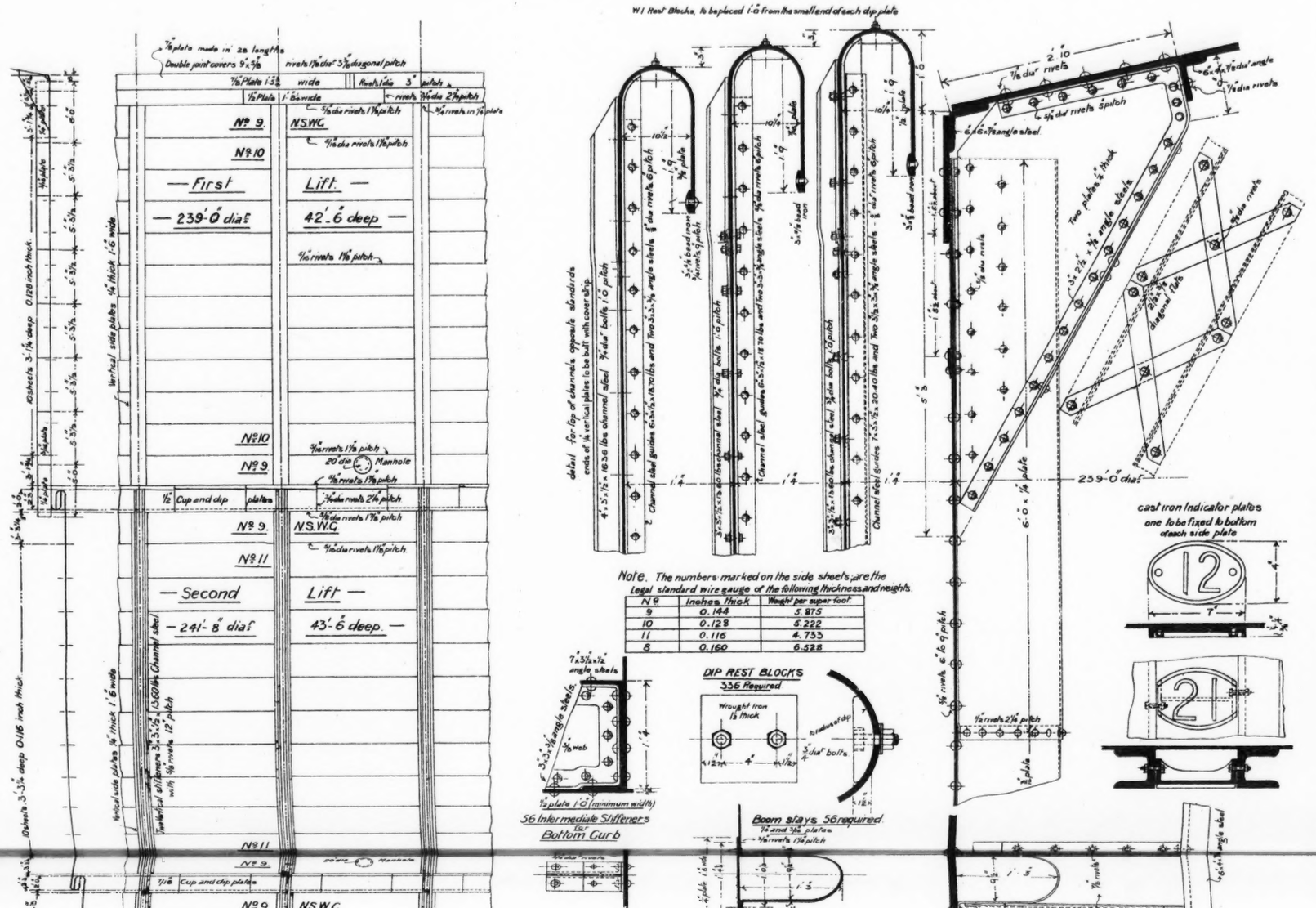
Adjustment of the carriages to the face of the guides is provided for by means of screws and lock-nuts; and the side cheeks of the carriages have slot-holes to allow of ¾ inch movement in either direction—the space (after adjustment) being filled up by packings, to present a solid surface to the pulley spindles.

Every bolt hole in the shell of the holder was carefully made gas-tight by felt grummets and washers; and the back of all the guides and stays, where attached to the side sheets, have inserted between them strips of painted canvas tape thoroughly saturated in red-lead paint.

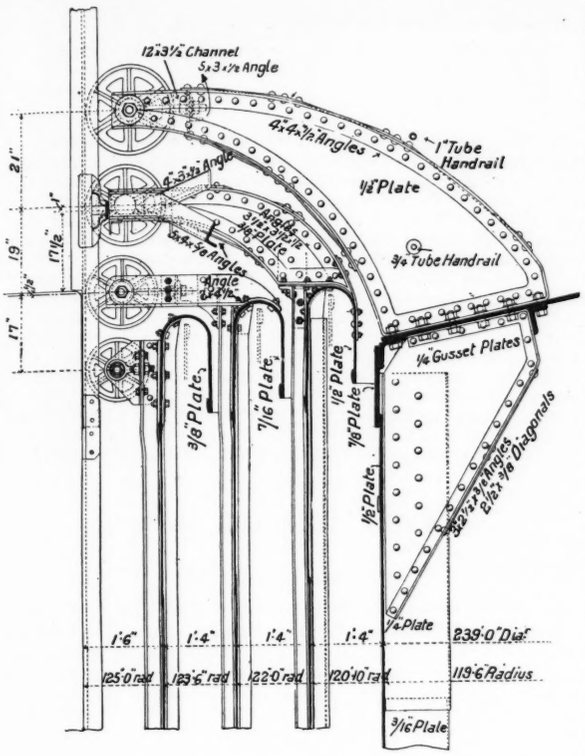

10 sheets 3'-2¾ deep 0.116 inch thick
10 sheets 3'-3 deep 0.116 inch thick
Vertical side plate ¼ thick 1'-6 wide
Two vertical stiffeners 4" 3"x7/16" x 16.36 lbs channel steel. with ⅝ rivets 12" pitch
Two vertical stiffeners 3"x3"x7/16" x 13.60 lbs Channel steel.
— Fourth Lift — 43'-0" deep —
— Third Lift — 43'-3" deep —
247'.0" dia'r
244'.4 dia'r
No 8
No 9
No 10
No 11
NSWG
Cup and strap plates
20" dia. manhole
Plan of carriages with cup above
cup removed.
4"x3"x7/16" channel steel
Cup 1'9" deep overall
7/16" cup plate
7/16" bolts 1'0" pitch
3"x3"x7/16" channel steel
10½"
1'9" cup plate
5'.6" long ¼" plate
4" dia hole to facilitate bolting
⅜" bottom plate
⅜" rivets 1'6" pitch
½" Boom plate
⅝" Boom plate
Inter lift
Second lift
Third lift
Fourth lift
Radial
Tangential
Radial
Lgth of Rollers
8"
10½"
14"
3"
2'8"
3"
3½"
1⅞"
⅜" web
1⅞" bore
Intermediate Stiffeners
Bottom Curb
Boom stays. 56 required
⅜" rivets 6" pitch
⅜" rivets 1'3"
⅞" rivets
3"x2½"x⅜" angle steel
6"x4"x⅜" angle steel
SCALE
10 feet
5 feet
J.W. MORRISON — ENGINEER —

SHEFFIELD UNITED GAS LIGHT COMP^{Y} — NEEPSEND STATION.

Nº 5 GASHOLDER. — SIDE SHEETS.


Nº 9.
Nº 10
— First
— 239'-0" dia^{r}
Lift —
42'-6 deep —
Nº 11
— Second
— 241'-8" dia^{r}
Lift —
43'-6 deep —
N.S.W.G.
Cup and dip plates
Vertical side plates ¼" thick 1'6 wide
Manhole
Note. The numbers marked on the side sheets are the legal standard wire gauge of the following thicknesses and weights.
56 Intermediate Stiffeners for Bottom Curb
DIP REST BLOCKS 336 Required
Boom stays. 56 required
cast iron Indicator plates one to be fixed to bottom of each side plate
239'-0" dia^{r}

Nº	Inches thick	Weight per super foot
9	0.144	5.875
10	0.128	5.222
11	0.116	4.733
8	0.160	6.528

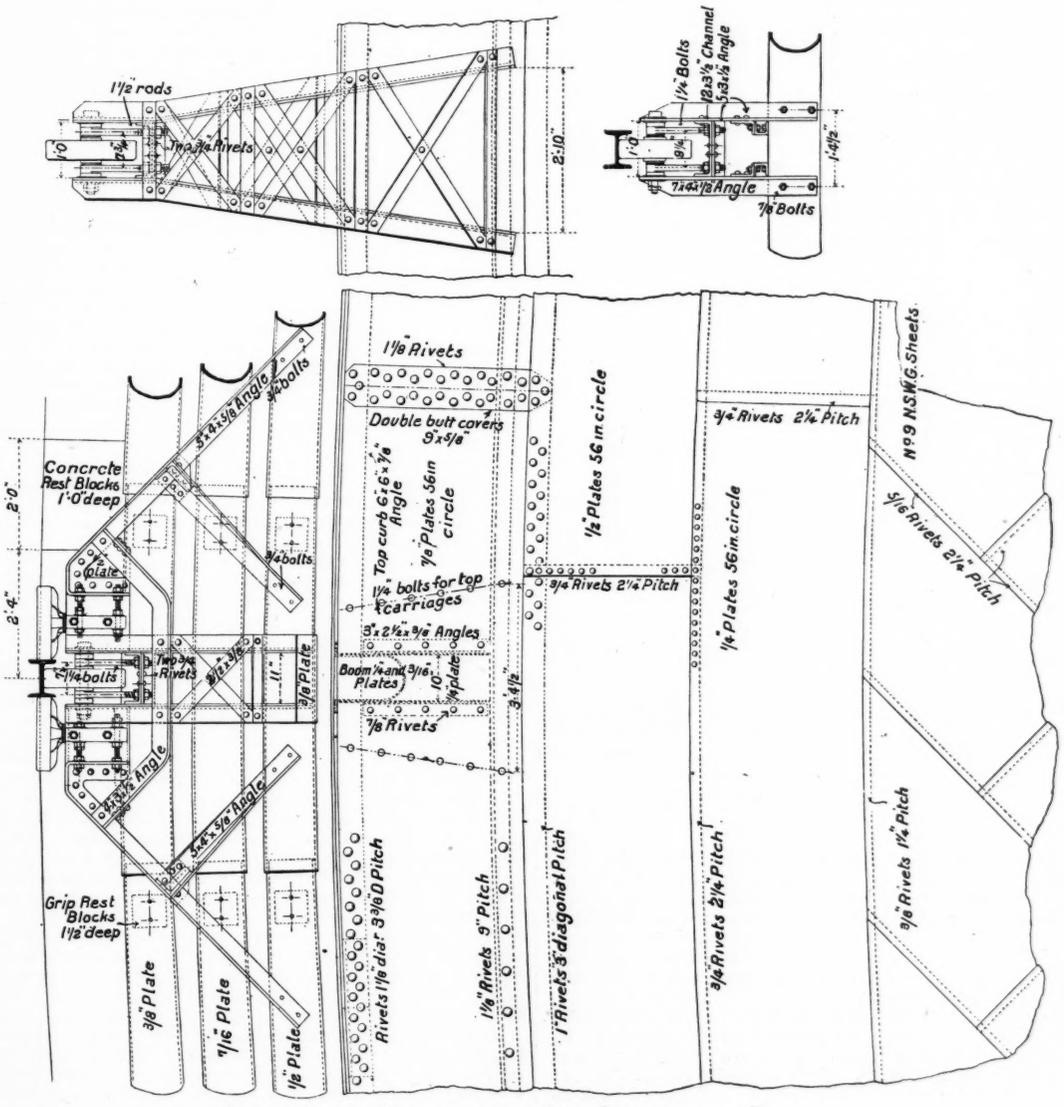


Figs. 1 and 2 show how the curb is stiffened on the $\frac{7}{8}$ inch row of plates by an angle steel, 6 inch by 4 inch by $\frac{7}{8}$ inch, with joint covers 2 ft. 6 in. long, arranged to break with that of the top curb, and connected by the gusset-plates to the side sheets. The curb plates are $\frac{7}{8}$ inch thick by 3 ft. 8½ in. wide. There are fifty-six of them in the circumference. The ends of the plates and curb angles are machined, to ensure a perfect joint. The second ring of plates is $\frac{1}{2}$ inch thick; the third ring, $\frac{1}{4}$ inch thick; and the remainder of the crown is covered by No. 9 N.S.W.G. sheets, about 6 feet by 3 feet, laid herring-bone pattern.

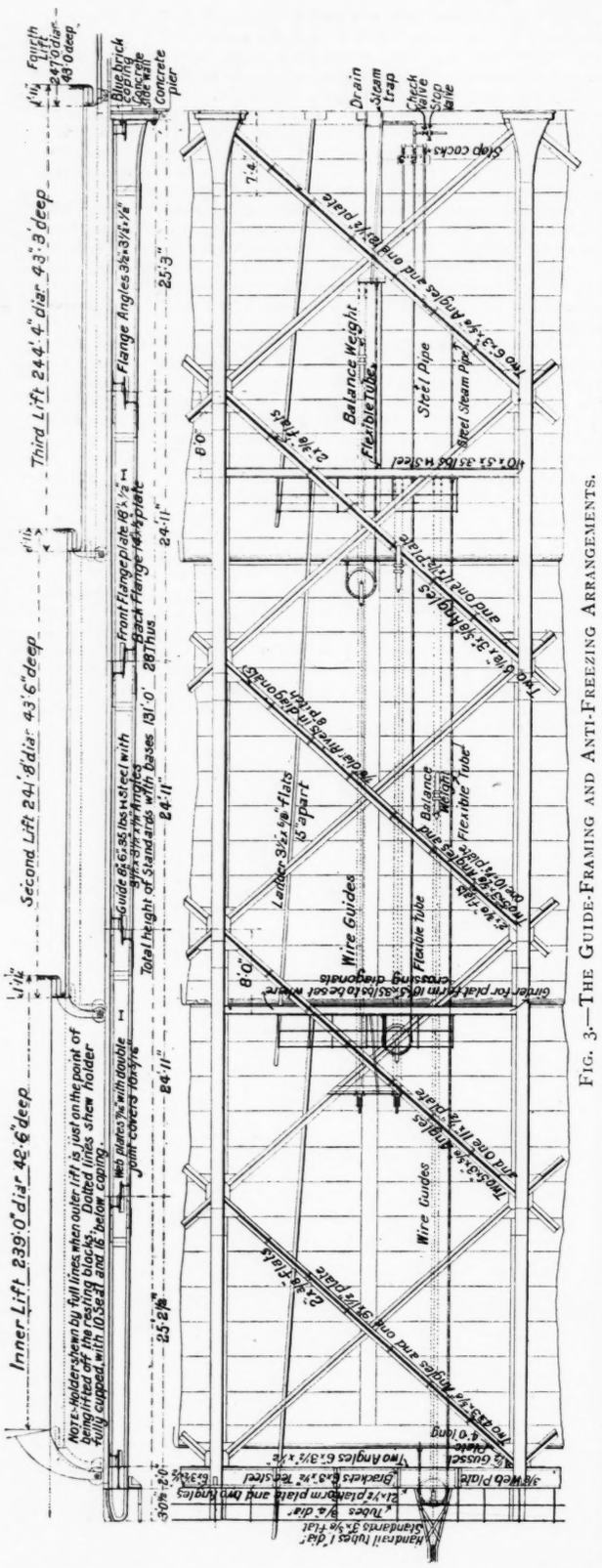
There are twenty-eight sets of guide carriages on the crown and grips. The grip of the second lift is provided, in addition, with tangential rollers. All these rollers revolve on gun-metal bushes, $\frac{5}{16}$ inch thick, which are held in position by a projection on each end, extending into the side cheeks of the carriages; and a cavity in the boss is provided for lubrication, fitted with brass screw-plugs.

In the crown, a water-sealed chamber over the inlet and outlet pipes is provided, with manholes. There are also three other manholes, placed at equidistant centres on the crown. To one of the covers is an air blow-off pipe, 6 inches diameter, extending down to 3 inches above the water level in the tank, and terminating with a 6-inch slide-valve. In each of the lifts a 20-inch diameter manhole, with cover, was inserted; the holes in the sheets being stiffened by double flats of 2½ inch by ⅜ inch secured thereto by $\frac{5}{8}$ inch countersunk rivets—the covers being fastened with ¾ inch set-screws.

The guide framing (fig. 3) consists of twenty-eight solid web-plate standards, resting on a cast-iron base, with one plate-girder 3 feet below the top of the standard, and five tiers of diagonal bracings. The standard guides are of 8 inch by 6 inch by 35 lbs. H-steels, secured to the front flange of the standard by 3½ inch by 3½ inch by ½ inch angles. The back and front flanges are composed of ½ inch plates, 14 inches and 18 inches wide, respectively, with double angles of 3½ inch by 3½ inch by ½ inch section. The web is of $\frac{7}{16}$ inch plate, and tapers from bottom to top. At the top of the guides, a cast-steel bell-mouth is formed, to guide the carriage rollers of the flying lift.



FIGS. 1 AND 2.—DETAILS OF THE GRIP CARRIAGES AND ROLLERS.


Fourth Lift 24'0"diam 43'0"deep
Third Lift 244'4"diam 43'3"deep
Second Lift 241'8"diam 43'6"deep
Inner Lift 239'0"diam 42'6"deep
Blue brick coping
Concrete pier
Drain
Steam trap
Check valve
Stop valve
Stop cocks
Balance Weight
Flexible Tube
Steel Pipe
Steel Steam Pipe
Flange Angles 3½×3½×⅜
Front Flange plate 16'×½
Back Flange 14'×⅜ plate
Guide 6'6"35 lbs H Steel with 3"×3"×⅜ Angles
Total height of Standards with Bases 131'0"
287 Nos
24'-11"
25'-3"
25'-2½"
7'-4"
6'-0"
8'-0"
Ladder 3½×⅛ Flats 15" apart
Wire Guides
Girder for platform 10'6"×35 lbs to be cast Inner
Web plates ⅜" with double joint covers 10"×⅜
NOTE.—Holders shewn by full lines when outer lift is just on the point of being lifted off the resting blocks. Dotted lines shew holder fully capped, with 10 Seal and 18" below coping.
Two 6.3½×⅜ Angles and one 12"×⅜ plate
Two 6.3½×⅜ Angles and one 12"×⅜ plate
Two 6.3½×⅜ Angles and one 12"×⅜ plate
Two 6.3½×⅜ Angles and one 12"×⅜ plate
Two 6.3½×⅜ Angles and one 12"×⅜ plate
Two 6.3½×⅜ Angles and one 12"×⅜ plate
Two four Arms in diagonals Bplan
Two 6.3½×⅜ Angles and one 11"×⅜ plate
Two 6.3½×⅜ Angles and one 11"×⅜ plate
Two 6.3½×⅜ Angles and one 11"×⅜ plate

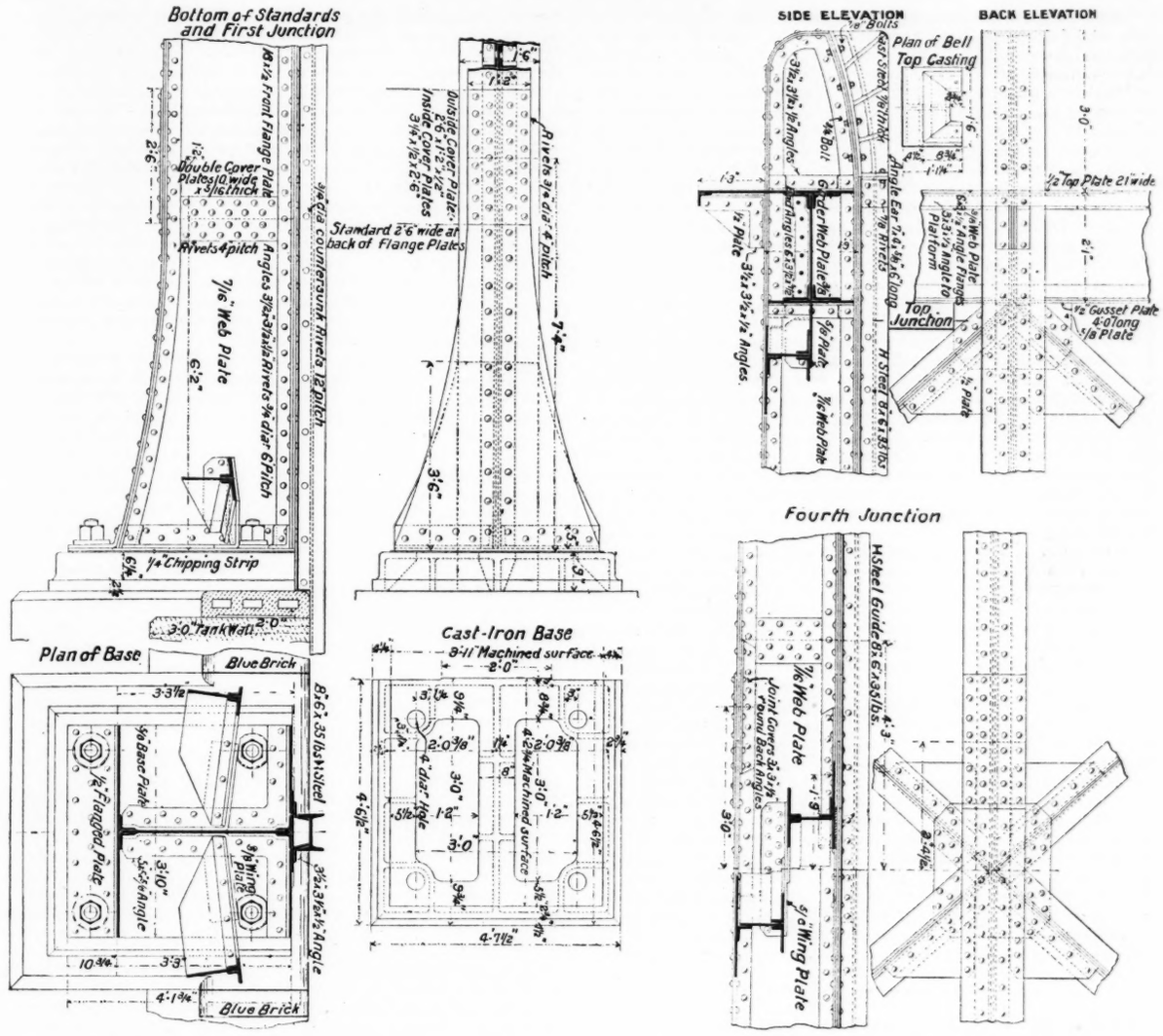


FIG. 4.—DETAILS OF THE GASHOLDER STANDARDS—THE BASE, THE FOURTH JUNCTION, AND THE TOP OF THE STANDARDS.

a second conduit, commencing at a junction with the above-named work, and terminating at the Victoria reservoir; and the necessary auxiliary works. They are all to be completed within five years from the passing of the Act. The Corporation may agree with the Halifax Corporation for a supply of water in bulk by the latter to the former, and may themselves supply in bulk beyond the borough, with the consent of the local authority concerned. The Act contains a number of protective provisions, some of which relate to the urban districts of Soothill Upper and Thornhill. It is provided that nothing in the Act is in any way to prejudice or affect the rights and privileges of the District Councils of these places under the Halifax Water and Gas Extension Act, 1870, or the obligation of the Halifax Corporation to afford these Councils a supply of water for all purposes, and at the pressure mentioned in section 11 of that Act, up to the maximum limit of a million gallons a day; and any agreement entered into between the two Corporations for a supply of water from Halifax is to be subject to the prior right of the District Councils to a supply. The Corporation may borrow £20,000 in connection with the construction of the works authorized, and any further amount which the Local Government Board may sanction; the former to be repaid within fifty years, and the latter in such time as the Board may specify. [*Messrs. Sharpe, Parker, and Co., Agents.*]

The Nottingham Corporation Act authorizes the construction of new works, consisting of a covered service reservoir, in the parish of Arnold, in the county of Nottingham, and a deviation of part of an aqueduct forming a portion of the works sanctioned by the Act of 1897, so as to connect it with the new reservoir. These works are to be completed within two years from the passing of the Act. The Corporation may apply any moneys borrowed or to be borrowed by them under the above-named Act for or in connection with the construction of the works now authorized. [*Messrs. Sharpe, Parker, and Co., Agents.*]

The Rhondda Urban District Council Act extends the time named in the Council's various Acts of Parliament for the compulsory purchase of certain lands for water-works purposes, to three years from the passing of the Act, and for the completion of the works (with a specified exception) to five years from July 2, 1906. The charge for water is to be upon the rateable value of the premises supplied. The water is to be efficiently filtered or otherwise treated so as to prevent it acting on lead in such manner as to endanger the health of the consumers. Any default in this matter is to render the Council liable to a penalty not exceeding £10 a day. For the above-named purposes, the Corporation may borrow such sums as they require, and as may be sanctioned by the Local Government Board. [*Messrs. Torr and Co., Agents.*]

By the Southport, Birkdale, and West Lancashire Water Board Act, the Board have obtained power to construct works in the parishes of Bickerstaffe and Aughton, in the rural district of West Lancashire. They comprise two reservoirs, a pumping-station, a water-tower and tank, and three pipe-lines; and they are to be completed, so far as one of the reservoirs and the three lines of pipes are concerned, within seven years, and as to the other reservoir and the water-tower and tank within ten years, from the passing of the Act. The Board are not to be bound to supply water otherwise than by meter to large institutions, except upon such terms as may be agreed upon. In the case of an ordinary dwelling-house, they are to accept a portion of a quarter's rate from persons leaving premises between two quarter days; and they are to allow discounts to owners of groups of houses who pay rates in advance. They may borrow for the purchase of land and the execution of the works authorized, the sum of £106,400; for new mains, service-pipes, meters, &c., £60,000; for additions to the existing Springfield pumping-station, £4000; and for certain pipes and other apparatus belonging to the Earl of Derby, in the parish of Bickerstaffe, whatever amount may be required for the purpose. All money borrowed for the works and the pumping-station is to be repaid within sixty years, and for the distributing plant within thirty years, from the date of the loan. The period specified in the Act of 1901 for the repayment of certain moneys authorized to be borrowed, is postponed. [*Messrs. Lewin, Gregory, and Anderson, Agents.*]

The Stockport Corporation Act empowers the Corporation to take water from the River Kinder before the reservoir to be constructed thereon has been completed; the quantity specified being 5 million gallons or more per 24 hours, so long as 2 million gallons or upwards per day are passing over the weir and measuring-gauge put up by the Corporation under the provisions of their Water Act of 1901. Authority is given for carrying out new works, comprising an intake weir on the right bank of the Kinder, a conduit or pipe-line from it to another sanctioned by the above-named Act, and a second extending from the one just referred to as far as the existing Bollinhurst reservoir, in the parish of Disley. Lands must be purchased within three years after the passing of the Act. The Corporation may borrow £6000 for carrying out the works sanctioned; to be repaid within twenty years from the date of the loan. [*Messrs. Lewin, Gregory, and Anderson, Agents.*]

The Swansea Corporation Water Act confers upon the Corporation authority to construct a service reservoir in the parish of Clase Rural, a break-pressure tank, and four aqueducts or pipe-lines. They are granted seven years for the completion of the works, for the carrying out of which, and for the general purposes of the water undertaking, they may borrow £250,000, to be repaid within thirty years. Among the protective provisions of the Act is one relating to the Swansea Gas Company. Before executing any of the works authorized which will interfere with the Company's mains or pipes, the Corporation are to give them notice, accompanied by plans and sections, at least 28 days before commencing the work, and compensate them for any damage they may do. [*Messrs. Sharpe, Parker, and Co., Agents.*]

The Tees Valley Water Act confers further borrowing and other powers upon the Water Board. The time specified by the Stockton and Middlesbrough Water-Works Act, 1890, for the construction of the Grassholm reservoir and other works is extended to Dec. 31, 1914; and the period allowed by the Tees Valley Water-Works Act, 1899, for making the Long Newton reservoir, to Dec. 31, 1906. For the purchase of lands and the completion of reservoirs, conduits, and other works (including workshops and workmen's houses), the three Corporations constituting the Board are authorized to borrow the following sums: Stockton, £185,970; Middlesbrough, £223,164; and Thornaby-on-Tees, £37,194—total, £446,328—all to be repaid within sixty years. Authority is given to the last-named Corporation to mortgage their borough fund and rate, as well as their district fund and rate and their share of the water revenue, for the purpose of securing repayment of any moneys they have the power to borrow, but have not yet borrowed, under any of the Water Acts. The Board are authorized to increase the reserve fund of £30,000 mentioned in their 1876 Act to £200,000, and to modify the provisions contained in that Act in regard to the application of their revenue. [*Messrs. Wyatt and Co., Agents.*]

TRIALS OF GAS-ENGINES WORKED FROM SUCTION GAS-PRODUCERS.

At the Annual Show of the Highland and Agricultural Society of Scotland, held in Glasgow last summer, there were some trials of suction gas-producer plants; and the results have now been published by the Society. The report is signed by Jonathan Middleton, Steward, and R. Stanfield, M.Inst.C.E., Engineer. The chief object which the Directors had in view in conducting the trials, it is said, was to afford members of the Society an opportunity of becoming better acquainted with the combination of the suction gas-producer and gas-engine as a cheap and convenient source of power, and at the same time to demonstrate that the suction gas-producer is a practical and simple appliance. A preliminary report on the trials has already appeared in the "Journal."*

The Society provided space in the showyard, free of charge, to exhibitors submitting plants for trial. No awards were made; and the trials were arranged so as to test the plants as nearly as possible under their ordinary working conditions. It was suggested to intending exhibitors that each firm should submit for trial two complete plants, consisting, in each case, of gas-producer, scrubber, &c., and gas-engine of suitable power. The plants were to be of the capacities of from 15 to 20 brake-horse-power at full working load, and of 5 to 8 brake-horse-power. No restriction whatever was imposed on exhibitors in regard to the size and capacity of the generators. Ten complete plants, exhibited by six firms, were submitted for trial. These were the "Acme," the "Campbell," the "Crossley," the "National," the "Tangye," and the Industrial Engineering Company. All the engines, with one exception, were fitted with indicator gear, and provided with revolution and explosion counters. The indicators used throughout the trials were of the "M'Innes-Dobbie" external spring gas-engine type, by Messrs. Dobbie, M'Innes, Limited, of Glasgow. The diagrams obtained were uniformly good and reliable, and showed an entire freedom from vibration.

At the conclusion of the trials the indicators were carefully examined, and were found to be in perfect condition—the pistons moving freely, and the parallel motions being without shake at any of the points. Scotch anthracite "peas," from Gartshore Colliery, were used throughout the trials. This coal cost 9s. 3d. per ton delivered in the showyard. It was of good quality; and none of the plants appeared to experience any difficulty in using it satisfactorily. Previous to the commencement of each trial, the producers were charged with sufficient coal (which was not weighed) to bring them up to their proper working condition; and the plants were required to be ready and working steadily for 30 minutes before the time of starting the trials. In each of the power tests, the time of starting was taken when the producer was filled with fuel to a predetermined level; the ashes and clinker, as far as possible, having been previously cleaned out, and the engine working steadily at the stated load. At the end of the test, the producer was brought as nearly as it was possible to judge to the same condition as to fuel, &c., as at the start, and the fuel consumption determined from the amount introduced into the producer during this period.

At the beginning and end of each test, the mass of fuel in each producer was consolidated as much as possible by working it from the top with a poker, in order to break down any arches that might have formed in the lower part of the producer. It is a well-known fact in connection with suction gas-producers, that after a few hours' run, clinker forms in the generator; and unless broken down by bars from the outside, it is apt to cause a hollow space in the fuel bed. Great care was exercised in removing the ashes and any clinker from the back of the fire, so as to prevent the main body of fuel in the producer from coming down. In the producers which were provided with two or more doors on the grate level, this difficulty was not so serious. Some designers of suction plants hold that the anthracite in the lower part of the producer should be disturbed as little as possible; but with a low-class quality of fuel, liable to clinker, it is obvious that some adequate provision should be made for readily removing the clinker, &c. Each plant was required to undergo a full and a half-power trial of not less than ten hours' duration; also a light-load trial for a period of five hours. It was stipulated that not more than two men would be allowed to look after and attend to each plant—producer and engine.

By making the duration of each power trial ten hours, it was considered that any error in arriving at an estimate of the fuel consumption would be minimized. At the same time, in view of the very small amount of coal used in the majority of the plants, it was necessary to draw attention to the fact that the fuel consumption obtained might be slightly under the true value, though the degree of error could not be large. In the light-load test the coal consumption was not measured, as the object was rather to ascertain the capabilities of the producers to supply gas to the engines when running without any load. All the plants that were tested completed the light-load test satisfactorily. If they desired, exhibitors were allowed to remove any ashes or clinker from the producers in the course of, and at the end of, the full and the half-load trials. This was done with all the producers except the Dowson, which were worked by the National Gas-Engine Company, and which were not cleaned out till the close of the third test. At the end of the power and light-load trials all the producers were thoroughly emptied, and an examination made for clinker. It was originally intended to weigh the ashes and clinker; but, unfortunately, on account of an accident, this became impracticable. On the whole, it was considered that the total amount of clinker formed during the trials was practically the same in each plant. The quantity was very small, and did not seem to have any disadvantageous effect on the working of any of the plants.

After the producers had been emptied and allowed to cool, a further test was made to ascertain the length of time required to get up to full working load, starting with the producer empty and cold. The time occupied was taken from the moment of inserting the firewood until the engine was carrying the same load as during the full-power trial; and this load it was required to sustain for twenty minutes. The average time necessary for the test seemed to be about fifteen minutes. With a few trifling exceptions, none of the plants experienced any real difficulty in running for the specified period of ten hours—in fact, there was no doubt that they could easily have worked quite well for a much longer time. The amount of attention which these plants required was remarkably small; very little labour being necessary for cleaning and stoking. Working under ordinary conditions—not a test—it was not considered that it would have been necessary to clear out the ashes and clinker, except, perhaps, at the end of each day's run. This, in any case, was a simple operation, which could be performed in a few minutes, and did not require the presence of a special attendant.

On the whole, the results of the trials were most satisfactory; and the economy, efficiency, and simplicity of working of the suction gas-producer plant was demonstrated beyond question. On the combined trials at full and half load (twenty hours altogether), the average coal consumption for all the plants was about 1 lb. of coal per brake-horse-power per hour; costing about $\frac{1}{20}$d.—coal at 9s. 3d. per ton. This was a remarkable result. It meant that an engine developing 20 brake-horse-power could be run at a cost of about 1d. per hour. Considering the manifest difficulties in arriving at strictly accurate results, no attempt had been made to place the various plants in any order of merit. For the combined trials, the coal consumption for the large engines

* See "Journal," Vol. XCI., p. 323.

was practically the same for all the plants. The greatest variation was to be seen in the coal consumption of the small plants—0·87 lb. to 1·30 lbs. per brake-horse-power per hour. This was to be expected.

It would be unjust to draw any invidious distinction between the various plants. Without exception they were simple in construction, and every detail, both in engine and gas-producing plant, had evidently been carefully considered with a view to giving the best results. The Committee felt that they had performed the task which they undertook—viz., demonstrating publicly the economy and the workability of the suction gas-producer plant. Tables of the results are given, from which the following figures are extracted :—

Plants of about 20 Brake-Horse-Power Capacity.

Full-Load Trial.

	Campbell Gas Engine Co.	Crossley Bros.	National Gas Engine Co.	Tangyes Limited.
Brake-horse-power	20·44	15·35	20·57	19·98
Indicated horse power	23·73	18·25	25·54	23·45
Mechanical efficiency, p. ct.	86·10	84·10	80·60	85·30
Total coal used, lbs.	190·00	96·50	165·75	166·00
Coal per B.H.P. per hour, lbs.	0·93	0·77	0·80	0·83

Half-Load Trial.

Brake-horse-power	10·69	9·06	10·48	10·72
Indicated horse power	15·12	13·00	14·76	14·59
Mechanical efficiency, p. ct.	70·70	69·70	71·00	73·50
Total coal used, lbs.	98·00	87·25	100·25	116·00
Coal per B.H.P. per hour, lbs.	0·92	0·96	0·95	0 92

Plants of about 8 Brake-Horse-Power Capacity.

Full-Load Trial.

	Campbell Gas Engine Co.	Industrial Engineering Co.	National Gas Engine Co.	Tangyes, Limited.
Brake-horse-power	8·25	9·72	9·74	8·34
Indicated horse power	9·66	—	11·88	10·86
Mechanical efficiency, p. ct.	85·40	—	82·00	76·80
Total coal used, lbs.	100·75	110·25	82·00	100·50
Coal per B.H.P. per hour, lbs.	1·22	1·13	0·84	1·25

Half-Load Trial.

Brake-horse-power	4·43	4·36	5·36	4·57
Indicated horse power	6·41	—	6·97	7·49
Mechanical efficiency, p. ct.	99·10	—	76·80	61·00
Total coal used, lbs.	41·50	56·75	49·00	67·50
Coal per B.H.P. per hour, lbs.	0·94	1·55	0·91	1·48

OBITUARY.

Mr. James Black, late Manager of the Gas Company at Newport, Fife, died at his residence there on Tuesday, the 7th inst. Mr. Black was at Newport for 42 years, retiring two years ago, at the time when the Corporation, who had shortly before that acquired the gas undertaking, opened new works which they had erected. When he began to manage the concern, the annual output of gas was 400,000 cubic feet. It is now over 15,000,000 feet. For a long time he performed all the duties pertaining to the gas undertaking; and on that account he was known over a wide district. He was all along highly respected as an official of much urbanity and unswerving uprightness.

Mr. James Gemlow, retired Gas Manager, died at his residence in Cairnie Street, Arbroath, on Thursday last, in the 85th year of his age. He was a native of Muirdrum, Panbride, in Forfarshire. For a time he was Manager of the Carnoustie Gas Company, and afterwards, for about thirty years, Manager of the Cupar-Fife Gas Company, from which post he retired twelve years ago, being succeeded by Mr. J. MacPherson. He has lived since in Arbroath. For some time, he had been in feeble health; but his end came suddenly. On his retirement from Cupar, he was made the recipient of a handsome testimonial. Both in Cupar and more lately in Arbroath he was held in much esteem.

We regret to record the recent death of Dr. J. Kellett Smith, the Chairman of the Hoylake and West Kirby Gas and Water Company. Deceased was born at Yeadon in 1836, and received his final preparation for the medical profession in the Liverpool Infirmary. He succeeded to the practice of his uncle, the late Dr. Chippendale, in that city, and carried it on until he retired in 1899. He was one of the promoters, in 1877, of the above-named Company, and had been its Chairman for twenty years—taking great interest in every detail of its working. He was made a Justice of the Peace for Liverpool in 1892, and regularly attended the Courts. Dr. Kellett Smith was a Freemason of upwards of forty years' standing; and at the time of his death he was Senior Trustee of the West Lancashire Masonic Educational Institution, as well as of the Masonic Hall and the Hamer Benevolent Fund. He was one of the founders of the West Kirby Lodge, of which he was the first W. M.; and he also held Provincial and Grand Lodge honours. The funeral took place in West Kirby Churchyard, and was very largely attended.

Mr. Leonard Rodwell Wilkinson has been elected to the seat on the Board of the Imperial Continental Gas Association rendered vacant by the death of Mr. Clarence Pigou.

GAS MANUFACTURE AND PLANT.

Past, Present, and Future of the Industry.

There was a large audience—members and guests of the Association of Engineers-in Charge—at St. Bride's Institute last Wednesday, to hear a paper read by Mr. W. H. Y. Webber on "Coal Gas Manufacture and Plant," in which the progress of the industry, and the manufacturing operations, were outlined. The chair was occupied by Mr. W. T. Hatch.

Mr. Webber, after pointing out the growth in the gas business that has taken place during the past quarter of a century, proceeded to discuss the manufacturing operations and processes of gas manufacture from the chemical and engineering points of view. On the subject of carbonization, he remarked that shovel charging—which was in use in the smallest works—was a good method in trained and trustworthy hands. The efficiency of the conscious animal agent was far superior to that of inanimate machinery within the limits of the strength of the animal. A man weighing 1½ cwt. could very easily shovel 3½ cwt. of coal into a 10-feet retort in three minutes, leaving it fairly level. A machine to do as much would run to tons of weight, and still need the man to direct it. The various kinds of stoking machinery were described; and considerable attention was devoted to retorts. With regard to vertical retorts, the author observed that the fortunes of these inventions were "on the knees of the gods," where there was room for plenty more; this was a field in which a successful inventor might reap substantial reward. Whosoever essayed to develop a new carbonizing system, however, must have good backers, prepared to pay up and wait, if he was to have any hopes of success. The condenser, the exhauster, and the purifiers were described; and then reference was made to the advantage enjoyed by gas over electricity in the matter of storage. The latter, he said, was an industry living literally from hand to mouth. The works were only fully occupied for about 17 per cent. of their time and capacity; and even for this fractional employment, there had to be a surplusage of land, buildings, and plant amounting to 25 to 40 per cent. of the generating capacity in use. How much the electric distributing plant was in excess of the requirements, he did not venture to inquire; but he summed up the matter in regard to generating thus: Seeing that not more than 60 per cent. of the assets paid for in a central station electricity supply undertaking ever earned anything, and that only for 17 per cent. of the time and capacity possible, it followed that this 17 per cent. of the 60 per cent.—which was about 10 per cent. of the total investment—had to bear the whole capital burden. This was the real reason why central station-made electricity, which cost at the works only 1d. per unit or less, could not be sold to the lighting consumer under about 4d. per unit to clear all expenses. In storage was to be sought the key to economical central station enterprise. In gas manufacture, whatever profit was made in the retort-house could be banked in the holders, and shared out between the companies and the public without any loss. After describing the carburetted water-gas system, the author remarked that strictly fair comparisons of the cost of making this and coal gas were hard to come by because of the difficulty of appraising the incidental and collateral advantages of the former; but the best proof of the value of the system lay in the fact that gas managers who once got hold of a good plant never gave it up. As to the expediency of mixing blue water gas with coal gas, he did not wish to dogmatize. The uses of gas, especially for lighting, had been so thoroughly changed by the success of the Welsbach principle of obtaining light from the heat and flame temperature of gas, instead of from its native luminosity, that the criterion of value of town's gas had been affected. The flame temperature of water gas was high—higher, indeed, than that of coal gas—so that in this respect it was not a diluent. On the other hand, its fuel value was only half that of common coal gas, while the reputed cost of the two gases in the holder was in about the same proportion, so that the economy of their commixture was "as broad as it was long." In conclusion, he said that town's gas was a particularly pure and strong fuel and illuminating gas. It contained no appreciable quantity of impurity, and seldom more than from 5 to 7 per cent. by volume of incombustible or inert diluents, which were of a harmless nature. Practically everthing that could be obtained from the gasification of the raw materials was turned to account.

At the conclusion of the paper, the Chairman proposed a hearty vote of thanks to Mr. Webber; remarking that there was present that evening one of the best audiences the Association had ever had. This showed that the gas industry was not "on its last legs." Many of them used electricity; but there were times when gas was called upon; and it seldom failed. This was one of its chief points. He called upon those present to indicate their appreciation of the paper by according the vote of thanks he had proposed; and this was done.

The first speaker in the subsequent discussion was Mr. A. F. Browne, of Vauxhall, who remarked that Mr. Webber had pointed out to them that the great evolution of the supply of gas had practically occurred within the last 25 years. It commenced, he told them, with the discovery of the use of gas for heating purposes; whereas for the previous 75 years, or thereabouts, it had been almost entirely used as a source of light. At the same time came the gas-engine, which was now of such great importance

to the gas industry. Then came gas-fires—another step in the utilization of gas as fuel—and various industrial applications of their commodity. Illuminating power was considered of supreme importance until somewhere about the middle nineties, when the epoch-making Welsbach mantle was produced. This altered the point of view of the whole question; and they then found they were able to use coal gas as a fuel for purposes of lighting, as well as for the other purposes that had comparatively recently come into vogue. The point of interest to all of them was the future. What was going to be the future of gas? Was there any reason to suppose that coal gas, which had held its own for so great a number of years, was going to lose ground? Mr. Webber had put before them in the fairest way the case for coal gas as it is; but he had not said quite so much about the future. He (the speaker) therefore thought it was desirable that a word or two should be said on this aspect of the matter. The gas industry did not fear electricity for lighting purposes. So far as could be seen at present, the introduction of electric lighting had been a blessing in disguise. To it, was no doubt traceable that great evolution in gas methods—especially as regarded lighting—which the last quarter of a century had witnessed. There was, of course, the question of the electric motor to be considered; and another competitor which had within recent times come somewhat prominently into notice was the suction producer. Opinions varied as to how gas would be able in the future to compete with the suction producer, which was regarded as an even more serious competitor than the electric motor. It had been assumed perhaps too generally that town gas would have very great difficulty indeed in maintaining its position as against producer gas for the supply of internal combustion engines. Mr. W. A. Tookey, in the "Gas and Oil Engine Record," had recently shown that town gas had not been quite fairly treated in comparisons hitherto made. He had stated that coal gas at 1s. 8d. per 1000 cubic feet was perfectly able at the present moment, every charge included—a matter that was sometimes left out in cases of comparison—to successfully compete with suction producer gas. This was a much higher figure than had been mentioned by some other experts. Still looking to the future, the question arose as to how the price of gas could be reduced. There was, of course, the usual business method of increasing the constituency, and thus favourably influencing the load-factor. Then there was the reduction of capital, the introduction of further labour-saving appliances, and the possible bringing forward of new methods in the carbonization of coal. The latter process had remained unchanged since the earliest days of gas manufacture. They were still, so to speak, carbonizing the coal in small parcels; and they were still subjected to all the troubles which made the process, from the chemical point of view, very much rule-of-thumb. But the minds of a great number of those engaged in the gas industry were engaged on the problem. So far as the reduction of capital per ton was concerned, there was every reason to believe the industry was awake to the necessity of doing its work cheaply. As regarded labour-saving appliances, too, it was fully awake, and willing to try any new arrangements that came along with a reasonable chance of being successful. But in connection with new methods of carbonizing, they approached the region of the unknown; and here no doubt there was an immense deal to be done. It had been claimed by sundry patentees that by introducing the coal in small parcels continuously into the retort—that was, without interrupting the process of gas making—more gas per ton of coal would be secured; but he was not sure that this had been well proved. Mr. Webber had alluded to the vertical retorts now in successful operation at Dessau. The figures published in regard to the plant did not, however, seem to show that anything more per ton of coal could be obtained than by the ordinary methods, though it was possible that commercially it might be more successful in that the charges in connection with the work were less. It seemed to him that they had to go very much further, and that, with the exception of the Dessau installation, inventors were still in the region of experiment. There was the Settle-Padfield retort, in which, though the feeding of the coal was continuous, the discharge of coke was unfortunately intermittent still. It was difficult to see how the coke could be discharged from this retort without either a loss of gas following when the door was opened, or without something being drawn into the retort which was not coal gas. Allusion had also been made to the Woodall-Duckham retort, in regard to which they hoped soon to hear more. It seemed to him that in this case the inventors were on the right lines. Not only did they feed the retort continuously, but they also removed the coke from the bottom without interrupting the process. The consequence of this was that there was no loss of that which should be saved, and nothing was drawn into the retort but that which was intended. There was one difficulty, it seemed to him, with the plant—that the coke had to be extracted through a water-seal. It might be that by this plan the gas would be so increased in volume, and its quality maintained, that it would pay for any depreciation the coke might suffer by having to be drawn through a water-seal as it left the retort. He believed a very large volume of gas was producible in this manner. Gas engineers already got all that was to be got out of a ton of coal; the question was whether they could get a greater value by re-arranging the products. An able address had just been delivered by the President of the Midland Junior Gas Association in which allusion was made to the fact that in externally-fired retorts an immense deal of heat was wasted. He said only 20 per cent. of the heat of the fuel used was realizable. On this point, the gentleman in question asked, "Why not do everything from within? Why should we not, in a producer, make water gas at the bottom and coal gas at the top?" And because there would be a balance of heat on the wrong side by that operation, he said they must necessarily supply to the producer a supporter of combustion. For this purpose he suggested—and it was original—that oxygen should be admitted to the producer, to supply the deficient balance of heat, so as to dissociate steam and distil the coal. The President stated that he had convinced himself that, by these means, from every ton of coal carbonized some 30,000 cubic feet of combined coal and water gas could be produced at a very greatly reduced price. He (the speaker) hoped it was true. They had not got it yet; but this was the direction in which they trusted to make progress. They hoped to reduce the price of their product, so that it would still hold the place it now occupied in the favour of the public. The question was: How were they going to get more value from every ton of coal they put into their retorts?

The next speaker was Mr. W. A. Tookey, who remarked that suction producer plants were new things, and, like most new things, were perhaps not fully understood. It was recognized by all now that the gas-engine had a greatly enlarging field; and it was quite right—looking at the matter from a gas-engine point of view—that the motive power should be supplied at the cheapest rate. Up till now, ordinary gas had not had a serious competitor, though electric motors were useful for intermittent work. In comparing the value of suction gas and ordinary gas, many things had to be taken into account. There was the cost of anthracite, and also the calorific power of the town gas. He thought that ordinary gas, of 600 B.T.U. per cubic foot, at 1s. 8d. per 1000 cubic feet, would compete with a suction producer where anthracite coal could be procured at 24s. per ton, and where 3000-brake horse power was worked throughout the year.

A point in favour of the reliability of gas was made by Mr. W. H. Booth, who said he had never been in a place where gas had failed; but in his own house, during the last year, the electric light had failed six times. This was due to lack of storage; and if ever electricians got hold of a system of storage equal to that of gas, there would be a very different story to tell. Another advantage of gas that was not sufficiently realized was its adaptability to ventilation. If lights were put into recesses in the walls, they would get rid of the products of combustion, and also promote ventilation.

Several other speakers having joined in the discussion, Mr. Webber replied to the points that had been raised. In the course of his remarks, he said that his greatest objection to the suction producer in connection with its competition with town gas, was that it was a noxious apparatus. It was not free from reproach under the Smoke Prevention Acts. They still had a chimney, ashes to cart about, and coal to get in; and they were still likely to poison the men. If they must have a suction producer, they should be careful that it was thoroughly well ventilated, and that there were no neighbours likely to object to a noxious smell. As for the cheapening of gas, for lighting purposes this was not wanted, as the incandescent system had already reduced the cost sufficiently.

Tests of the "Bonbac" Mantle.

We have on several occasions laid stress upon the necessity for maintaining a high standard of efficiency in gas-mantles; and we are glad to find that this is fully recognized, among others, by the Wholesale Fittings Company, Limited, the makers of the "Bonbac." Some trials of this mantle, extending over 750 hours, have lately been made at the Imperial Physical Laboratory at Charlottenburg, with the following results: After burning 50 hours, 101 standard English candles; 200 hours, 100 candles; 500 hours, 94 candles; and 750 hours, 93 candles. We are informed that photometrical tests made by the Company themselves have shown that the mantle has an illuminating power of 88 standard candles after burning for 2000 hours.

The Manchester and District Junior Gas Association will next Saturday visit the gas-works of the St. Helens Corporation—permission having been granted through the kindness of Mr. S. Glover, the Engineer and Manager. The members will meet at the gas-works, Warrington Old Road, at 3 p.m.

A French Treatise on Incandescent Gas Lighting.—We have received from the Publications Scientifiques et Economiques of Paris a treatise on "Incandescent Gas and its Application to the Lighting of Towns, Railways, and Coasts," by Paul Lévy, C.E. The work has attracted the attention of a number of professional men in France, and the author was awarded a silver medal in Group VI. at the Liége Exhibition. We shall give in an early issue an epitome of its contents.

Natural Gas.—In recently noticing the general reports and statistics on mines and quarries of the United Kingdom for 1904, it was mentioned that the yield of natural gas was 774,800 cubic feet, of the value of £155—thus showing a diminution on 1903, the figures for which were 972,460 cubic feet; the value being £194. In contrast are the values of the natural gas produced in the United States in 1903 and 1904. In 1903, the value was $35,815,000, and last year $38,496,760.

COAL-HANDLING PLANT AND "D. B." PROJECTOR AT ALLOA.

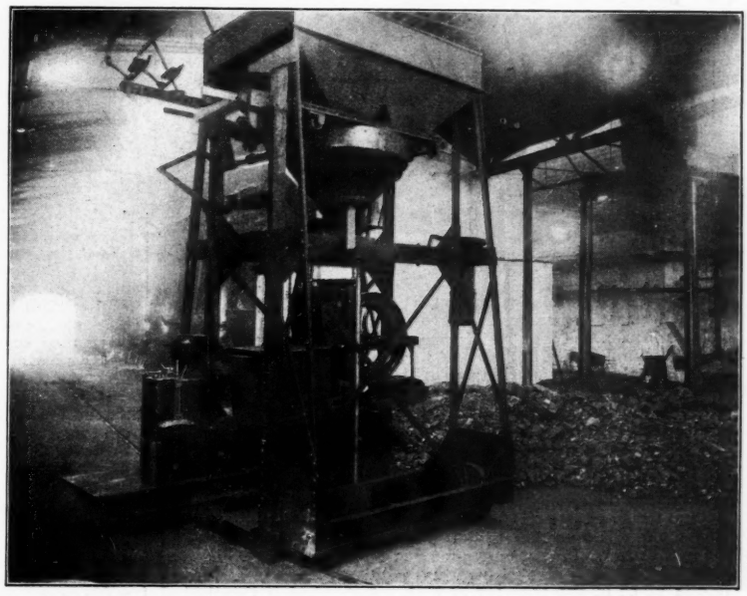
An installation of coal-handling plant, with a De Brouwer projector, has been introduced at the Alloa Corporation Gas-Works. So far, it is the first adoption of this particular plant in Scotland; and the following particulars, in conjunction with the illustrations, will therefore doubtless be of interest.

The quantity of coal carbonized at Alloa last year was 11,600 tons, from which 103 million cubic feet of gas were manufactured. The retort-house contains eight beds of eight retorts, each 9 ft. 3 in. long, and three beds of six, all set back to back. The coal-store is under the same roof. The retorts not being "throughs" necessitated the arrangement of the installation so as to permit of the one projector being worked from both sides of the retort-house; and this has been accomplished by simply carrying the rails on which the charging machine travels round a curve at the west end, as shown on p. 458. This is a unique feature of the installation; the plant being arranged to suit the retort-bench as originally designed. Any future extension of the bench will be carried out by dismantling the old one, with ovens of sixes, at the opposite end of the house. The introduction of the plant has not required any structural alterations in the retort-house. The charging-machine, with the overhead hopper, was made of less than the customary height, because of the somewhat low roof, to permit the machine passing round the end of the retort-bench.

Electricity is the motive power for working and propelling the machine; the coal-breaker and elevator being belt-driven. A new engine-house has been erected contiguous to the retort-house, and contains a 25½ brake-horse-power "National" gas-engine, of the high-speed electric lighting type, with a dynamo developing 9 kilowatts at 220 volts continuous current (supplied by the British Electric Plant Company, Limited, of Alloa), coupled direct by means of a "Zodel" flexible coupling. There is sufficient space left in the engine-house for another set of generating plant being put down in view of coke discharging and handling plant being introduced at some future time. A 6-inch belt is provided for driving from the pulley on the engine crank-shaft to a pair of fast-and-loose pulleys on the line shaft carried on brackets on the engine-house wall. The belt striking gear for starting and stopping the coal breaker and elevator is operated from the inside of the retort-house.

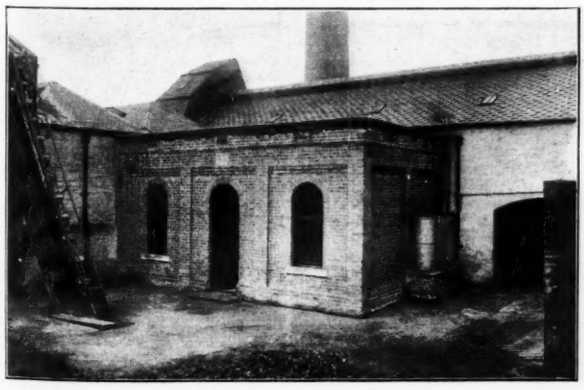
The pit in which the coal breaker and hopper are placed was constructed of concrete. Considerable trouble was experienced here with water; the depth of the excavation being 16 feet from the retort-house floor, and about 8 feet beneath the low-water level of the Forth, which passes quite close to the works. The hopper over the coal-breaker is fixed level with the retort-house floor; the carts tipping in the coal direct. It should be mentioned that at present there is no railway siding into the works. A bye-pass shoot is provided for directing nuts to the elevator boot without passing through the breaker, which is of powerful four-claw type to break large lumps of coal, and is capable of adjustment by means of a regulating arrangement opening or closing the claws, and so breaking the coal to any desired size. The bucket elevator delivers coal into an overhead storage hopper of 12 tons capacity, with slide-doors worked by hand levers from the retort-house floor, for feeding coal into the hopper on the charging-machine.

The projector is fixed in a framework mounted on wheels, and travels in front of the retort-bench on rails fixed in the floor. The projector can be raised, lowered, and adjusted to the heights of the various tiers of retorts by means of chains passing round the drum working in a cast-iron frame at the base of the machine, and driven from gearing from a 7-horse power electric motor, which also drives the propelling gear; and a clutch is arranged so that the machine can be propelled, or the projector hoisted or lowered, by a single movement of the lever. The motor is fitted with a reversing arrangement by which the direction of the hoisting or travelling can be changed. The large grooved pulley is 39 inches in diameter and 14 inches in width on the face; the groove being 8 inches wide by 4½ inches deep. The belt is of rubber, and is made slightly thicker in the centre, where the coals come in contact with it; experience elsewhere having proved the superior virtue in wearing qualities of rubber as compared with leather. The motor on the projector is of 3½ brake-horse-power. The hopper fixed on the machine is of 2½ tons capacity.



THE "D.B." PROJECTOR AT ALLOA.

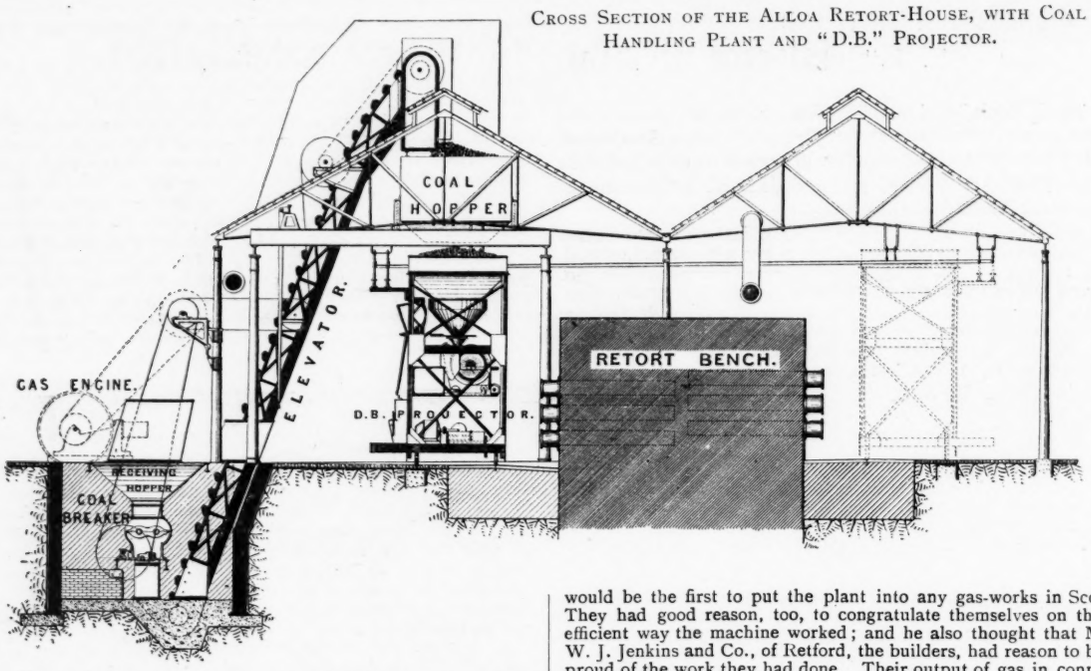
The experience in working the projector has been very satisfactory. With eight-hour shifts, one man per shift does all the charging of the retorts and the handling of coal into the hoppers; the other men merely drawing the retorts, cleaning the producers, &c. The men have taken kindly to the machine, and have been ready to perceive its advantages. What is specially striking about it is the extreme ease with which it can be manipulated, and the aptitude of the ordinary stoker in learning its working. That it is capable of performing the work of charging retorts in a perfectly satisfactory way, with even layers of coal, there is not the least doubt. It has been found quite an easy matter to put in a heavy, a medium, or a light charge of coal as desired, according to the condition of the retorts. To charge a 9-foot retort takes about 14 seconds. The plant has been in operation only a few weeks, and as yet it is too soon to speak of resulting economy in wages and other undoubted advantages; but compared with hand-stoking, as formerly, only about half the number of men are required.



THE ENGINE-HOUSE AND RETORT-HOUSE EXTERIOR, WITH COAL ELEVATOR ON ROOF.

The formal inauguration of the new plant was made last Thursday, at the annual inspection of the gas-works by the Town Council. First of all, the coal breaker and elevator, which are driven by shafting from the gas-engine, were started by Provost Arrol. These having been found to work smoothly and expeditiously, attention was directed to the De Brouwer charging machine. The man in charge of it—one of the ordinary retort-house workers—first filled the hopper from the overhead hopper, and then, the machine standing clear of the retort-bench, proceeded to give an illustration of how the arrangement worked, by discharging coal into an open wooden trough of the same dimensions as a retort. This revealed the remarkable evenness with which the coal is laid in the retorts; the coal used being nuts—the variety employed in the works at the time. Then the machine was run along to the bench, and was placed in position in front of an open retort. All being now in readiness, Provost Arrol took his station on the platform of the machine, and, being directed what to do, set the apparatus going. The operation of charging the retort was timed, and was found to be 11 seconds. Other retorts along the south side of the bench were charged; and then the machine was run round the end of the bench, and a row of retorts on the north side was charged. The times taken for each charge ranged from 9 to 12 seconds. The

Cross Section of the Alloa Retort-House, with Coal Handling Plant and "D.B." Projector.



company were afterwards invited to the office of the Manager, where light refreshments were served.

Provost Arrol said they had from year to year seen many alterations and improvements in the works; and these had always been in the way of advancement. He thought that all the credit was due to the late Manager (Mr. Alexander Yuill) and the present Manager (Mr. J. W. Napier) for their foresight in the planning and making of arrangements, always with a view to the development of the gas industry. The excellent plant they had put in motion that day was driven by electricity; they had bound the two together. They were not now two enemies, but were the greatest friends. They had applied gas to the driving of the engine; the engine drove the generator; and the generator supplied current to drive the rubber band by which the retorts were charged. The machine was the only one of its kind in Scotland. It took only 9 seconds to charge a retort, whereas manual labour occupied 2½ minutes; so that they had almost 2¼ minutes saved in the charging of each retort. And if they looked further, the amount of gas which escaped during the 2½ minutes, while the man was charging, was now all sent forward to the gasholders. If they took the 2¼ minutes for each retort over a year, what an enormous saving of gas that would be. They had reason to congratulate Mr. Napier, in that he had advised the Committee to have a De Brouwer machine; and he was also to be congratulated upon the fact that the Committee had had sufficient enterprise to come forward and say they would be the first to put the plant into any gas-works in Scotland. They had good reason, too, to congratulate themselves on the very efficient way the machine worked; and he also thought that Messrs. W. J. Jenkins and Co., of Retford, the builders, had reason to be very proud of the work they had done. Their output of gas in connection with engines had grown 25 per cent. in Alloa last quarter, showing how much coal was being done away with, and how much gas was being used now. It seemed as if, in a few years, they would have a day consumption as large as the night consumption, which would make matters very much more profitable for them.

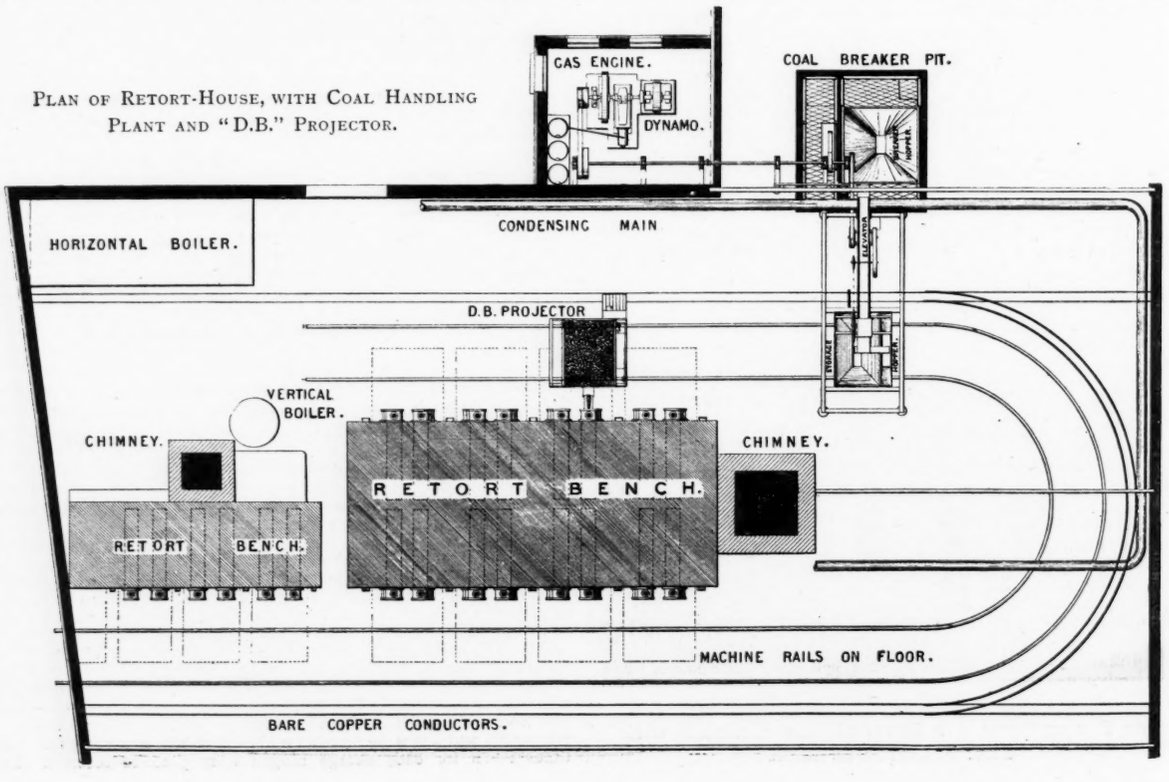
Bailie Duff said he was much struck at the efficient way in which the machine did the work it was intended to do. The Council had been most fortunate, not only in their Gas Manager, but also in having the Provost as Convener of the Gas Committee. Mr. Napier would bear him out when he said that whatever he suggested, the Provost always did his very best to go in with, if it were to tend to increase the efficiency of the gas-works. They were fortunate in having such cheap and good gas. If the undertaking should be obliged to come into severe competition with suction gas, he did not think they could have a better man than Provost Arrol at the head of affairs.

Bailie Cousin and Bailie Crawford also made some highly complimentary remarks.

Provost Arrol expressed gratification at the courteous manner in which everyone had spoken. His office as Convener of the Gas Committee had been a very pleasant one; it had been the Managers who had made the gas-works the success they were, because if it had not been for the efficiency of Mr. Yuill and Mr. Napier, the Convener could have done nothing.

A hearty vote of thanks to Provost Arrol terminated the proceedings.

Plan of Retort-House, with Coal Handling Plant and "D.B." Projector.



SOUTHERN DISTRICT GAS MANAGERS' ASSOCIATION.

In spite of the counter attractions in London on Thursday, the members of the Association turned up in good force at the Hotel Cecil for the autumn meeting, at which the chair was occupied by the PRESIDENT (Mr. S. Carpenter, of Dorking).

The proceedings were opened by the minutes of the last meeting, as appearing in the Technical Press, being taken as read and confirmed.

NEW OFFICE-BEARERS.

RETIREMENT OF THE HON. SECRETARY.

The PRESIDENT said he had much pleasure in proposing that the Vice-President (Mr. F. W. Cross, of Lea Bridge) be the President for 1906. He was well known to the members, and had many qualifications which well adapted him for the position. Mr. Cross had had an almost unique experience, having occupied the position of Manager of a gas-works in the Far East, as well as of English works. He (the President) was sure his year of office would prove that a suitable selection had been made.

Mr. A. E. BROADBERRY (Tottenham) seconded the motion, which was heartily agreed to.

Mr. W. E. PRICE (Hampton Wick) proposed that Mr. H. W. Woodall be elected to the Vice-Presidency. He was the worthy son of a worthy sire. His father did well as their President; and he was sure the son would follow in his footsteps. Another thing which commended him to the members was that he lived in a particularly nice place.

Mr. A. W. ONSLOW (Woolwich Arsenal) said that, having been associated with Mr. Woodall on the Committee, he very much appreciated him, and had the greatest pleasure in seconding the proposal.

The proposition was cordially adopted.

The PRESIDENT said they all regretted that they were about to lose their Hon. Secretary. It was almost like putting a new spring into an old clock. That needed a great deal of regulating. At the same time, Mr. Helps had told them he was quite unable to carry on the duties. For this they must all be sorry. They had, however, selected a well-tempered spring in Mr. Browne, of Vauxhall. The members all knew him, and were aware of his tact and ability. He was sure he would fill the office to the best of his ability, and to the honour of the Association.

Mr. J. PATERSON (Redhill) proposed, and Dr. COLMAN seconded, that Mr. Browne be appointed Hon. Secretary.

Mr. BROWNE said before the motion was put to the meeting, perhaps the President and members would allow him to make a few remarks, because, if the motion was put, it might be too late. Mr. Helps had been obliged to come to the determination to vacate the office which he had filled for eighteen years. He had won the esteem, the respect, and—he need not be afraid to say more than that—the affection of every member of the Association. There was no doubt that his services during the eighteen years he had been Hon. Secretary had been simply splendid. They knew that the Association had a history behind it—a history of which it need not be ashamed; and from the large extent of the country it covered, and from its membership, they might say they were not the least among the District Associations. They had been very fortunate in the officers of the Association; they had had many good Presidents—some of the leaders in the profession had not disdained being Presidents of the Association; and they had been served by excellent Committees. But the whole thing had turned upon the permanent official. That official had been their friend Mr. Helps. He had, they all knew, peculiar gifts and endowments to qualify him for the position. He was a man of affairs; and a man of great administrative ability. Whilst he had led a very strenuous life, because, managing an important gas-works with great ability, and administering the affairs of a large Gas Company in an important town in a growing district, he had at the same time utilized his peculiar talents for the benefit of the gas industry as a whole. He (Mr. Browne) feared that the hon. secretaryship of the Association was no sinecure; and if they were good enough to elect him, he should find that out very shortly. (Laughter.) But Mr. Helps had been for many years also Hon. Secretary of the Incorporated Institution in addition, and since then he had been Hon. Secretary of the Institution "one and indivisible." He was largely instrumental in bringing about the amalgamation—in fact, he did most of the work. That had been his history; and was it surprising, therefore, that the time had come when he felt he must lay down some of his work? He had shown in his position, and especially in connection with the Institution of Gas Engineers, the gifts of the statesman, and the adroitness of the diplomat; and there was no question that he was a unique personality in their industry. He did not think there was anybody else quite like him, and it was very probable there never would be. They were proud of him as a representative member of their industry. He was of that aristocracy of character and intellect to which they might all be proud and pleased to defer. But now they had to part with Mr. Helps; and they could do no more upon this occasion than express to him their very enthusiastic, earnest, and heartfelt thanks. This, he (Mr. Browne) was sure they all did from the bottom of their hearts. It was something to remember in the history of the Association that there had only been two Secretaries (though it was 35 years old), in the persons of Mr. Chapman, who served the Association for seventeen years, and Mr. Helps, who had served them for eighteen years. Now about his successor. Let there be no misunderstanding on the subject, as he was not quite certain that there was a clear understanding between himself and the Committee. About a fortnight ago, he received a most delightful letter from Mr. Helps. He was highly surprised; but he felt very proud to think that the Committee, in a temporary difficulty, had turned to him. They had had two able Secretaries; and they wanted another permanent official who would be sufficiently young and adaptable to qualify himself for the position which had been filled by these gentlemen so ably and for so long. Perhaps the new man might have the courage to emulate Mr. Helps. If he did, Mr. Helps would be the first to wish him God speed. From what he could gather, the Committee had either not yet discovered, or had not yet persuaded, the best man in their ranks; and he (Mr. Browne) rather fancied that it was not so much that they had not yet discovered him as that they had not yet persuaded him. In the meantime, they had asked—well, an elderly gentleman to take the position (laughter)—and he had never had a better compliment paid him in his life than this requisition from the Association that he should undertake this duty for a short time. The Committee had asked him to do this for a year; and he had extracted from Mr. Helps an undertaking that it should not be for more than two years.

The motion was then unanimously carried.

The PRESIDENT remarked that Mr. Helps was not going to entirely sever his official connection with the Association, as he had consented to serve on the Committee.

Mr. J. DONALDSON (Tonbridge) proposed, and Mr. D. T. LIVESEY (East Grinstead) seconded, the election of Mr. J. W. Helps and Mr. T. N. Ritson as members of the Committee.

This was heartily agreed to.

Moved by Mr. DOUGLAS HELPS, and seconded by Mr. R. B. GREEN (Mitcham), Mr. A. Dougall and Mr. J. L. Chapman were re-appointed Auditors.

NEW MEMBER.

The HON. SECRETARY remarked that there was only one gentleman for election to membership on this occasion, and that was Mr. H. K. Kindler, of Maidstone.

On the proposal of the PRESIDENT, seconded by Mr. F. C. TAYLOR (Shanklin), Mr. Kindler was elected.

NAPHTHALENE SUB-COMMITTEE—EXPERIMENTS AT SILVERTOWN.

Mr. W. E. PRICE (Hampton Wick), as Chairman of the Naphthalene Investigation Sub-Committee, was called upon by the President to report progress. In response, he said he feared there was not very much upon which he could report since the last time a statement was presented to the members. Matters were progressing. Facilities had been offered for an investigation to take place at the Silvertown works of the Gaslight and Coke Company, where the arrangements were suitable for experimenting with certain methods of condensation. It would be premature just now to go into details, because it had practically taken all the time for preparing for these experiments. They had commenced, and had been going on for a few weeks; and he had every hope that, when the Association next met, the Committee would have something of an interesting character to report. They were moving slowly. Unfortunately, they were compelled to do so, because they were suffering, as the members would probably remember, from want of funds. They had made every endeavour to get more money; but the Companies the members of the Association represented had not come forward in the way it was hoped they would. Therefore the matter would have to go along at a slow rate. If the Association wished this research should continue, the members would have to do something to obtain funds, because it was impossible to proceed without. Whether it should go on through the Association, or whether it would have to be put into other hands, was a matter that would have to be considered, seeing that the funds they had available were very small indeed. The experiments at Silvertown were on a good basis as to cost, which was but little, as the Gaslight and Coke Company were giving every facility and were themselves meeting a great part of the expense. He was afraid this report was not very promising. Perhaps, in the next one, there might be something more interesting.

Mr. J. W. HELPS (Croydon) said they ought to express their thanks to the Gaslight and Coke Company for their kindness in placing their works at the disposal of the Association, and helping them in the way they had done. The work that Dr. Colman had undertaken with the assistance of the Gaslight and Coke Company at Silvertown promised extremely good results; and, as Mr. Price had said, at the next meeting it was hoped something of importance would be told the members. The members ought certainly to express their gratitude to the Gaslight and Coke Company. He moved accordingly.

Dr. COLMAN said he had much pleasure in seconding the motion. He felt exceedingly grateful, both as a member of the

Association and on his own account, to the Gaslight and Coke Company for the extremely kind way they had come forward, and for the hearty manner in which all the officers concerned had entered into the experiments. He might especially mention Mr. Goulden, the Chief Engineer, and also Mr. Wilton and others at the Silvertown works. He certainly thought their gratitude was due to the Company and these gentlemen. Regarding the hopeful expressions of the Chairman of the Sub-Committee and the Hon. Secretary as to the nature of the report at the next meeting, he trusted the members would not raise their expectations too high. They were now in the winter six months, and it was the summer six months in which the work would tell the most, and which work they had had to practically drop this year.

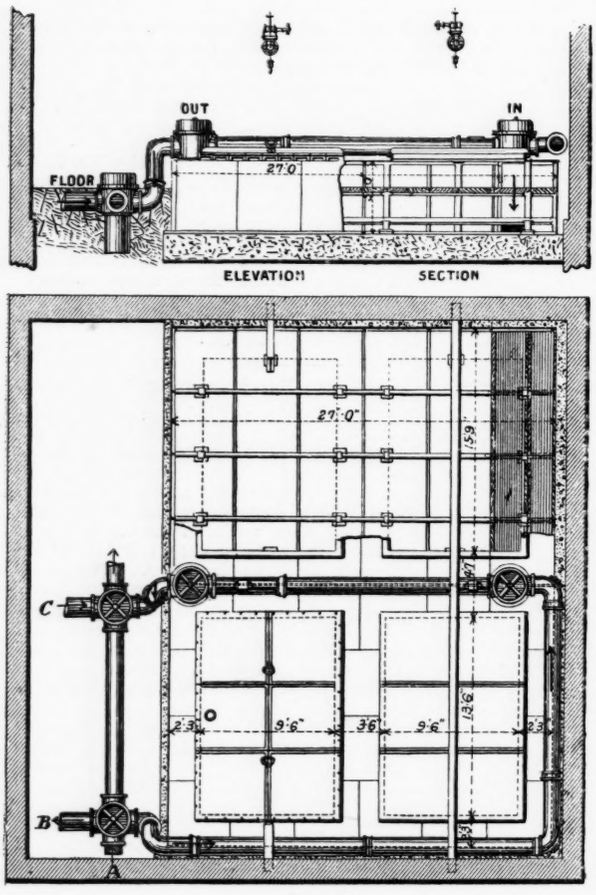
The PRESIDENT remarked that the difficulty was the financial one. With the necessary means, no doubt the experiments would go forward very much quicker than at present.

The motion was unanimously carried.

Mr. N. H. HUMPHRYS (Salisbury) read the first paper on—

OXIDE PURIFYING BOXES.

On receiving an intimation about a month ago, to the effect that a paper from me would be very acceptable for the November meeting, it occurred to me that the present communication, though possessing no striking claim to novelty, might serve to fill a gap. I am quite aware that many engineers have put down purifiers of the form about to be described, also that various devices have been proposed in the way of valves opening directly into the boxes.



RAMSDEN AND SMITH'S PATENT ARRANGEMENT FOR WORKING PURIFIERS.

Commencing with the customary historical notice, I may say, in reference to the purifying arrangements at the Salisbury Gas-Works, that the building shown on the diagram was erected in 1870, and furnished with a set of apparatus much in vogue at that period, comprising a set of four boxes, each 12 feet square, supported on columns and girders at a height sufficient to give clear working room below the boxes and to enable the space to be used as a revivifying floor, and generally known as the overhead system. Three of the vessels were connected to a centre-valve arranged to work in rotation, two on and one off; and there was an independent four-way bye-pass valve for the fourth, which could be used as a lime-box or as a check-purifier. At that time the make was about 40 million cubic feet annually. Passing on to the year 1882, the output had meanwhile increased to 60 millions; and a second house was built adjoining the first. This was fitted up with two 20-feet boxes, also on the overhead system, controlled by two four-way valves. A main inlet and a main outlet valve was also provided, which admitted of either house being used first, or alone.

This arrangement of dividing the purifying plant into two separate sections is very convenient in working, as either section can be cut out for repair for a few weeks, during what used to be the slack season, without interfering with the regular operations. The idea was that the two 20-feet boxes might be used for oxide, then two 12-feet boxes for lime, and the fourth 12-feet box as a check oxide box. In the diagram, A is the inlet from the washer to the inlet valve; B, the inlet branch leading to the two 20-feet boxes in No. 2 house; C, the outlet branch from the same; and D, the outlet leading to the station meter. The boxes can be used in any order of rotation and in any number from one up. This arrangement answered excellently until, in the course of years, the annual output had reached and exceeded 100 million cubic feet, when the 12-feet boxes began to give trouble from back-pressure. They could not be used with lime or with anything but the best Irish bog ore, and for a time the bulk of the work was taken by the two 20-feet boxes; and it was under these circumstances that the extensions about to be described were carried out. [Perhaps I should here mention that a local clay ironstone, containing 66 per cent. of ferric oxide, is largely used in the South-West district as being cheaper than bog ore. But being rather heavier, it requires somewhat ample purifying area, and cannot be used in boxes that are small in proportion to the make.]

The Tichborne claimant is credited with the astute observation that some men have money and no brains and others have brains and no money. Paraphrazing this saying, we might apply it to gas undertakings. Some have power to occupy 10 acres of land, but no authority to raise capital sufficient to cover more than two or three; while others have ample capital powers but are limited in the matter of acreage. The Salisbury undertaking comes in the latter category. It has large capital powers, but is limited to 3 acres of land. The only reason I have heard for the limitation of the area of land to be occupied, is that it is intended as a preventative of nuisance to adjoining properties. In this respect it is singularly unfortunate, for there is no greater cause of nuisance in gas-works than cramped and confined purifier-houses and revivifying floors. So far as Salisbury is concerned, not only has the acreage reduction been absolutely without benefit to anyone concerned, but it has indirectly cost the undertaking thousands of pounds. On one occasion, they had to reject a most advantageous offer of additional land in order to avoid exceeding the limit. Among other things, it has affected the area available for purification, and necessitated that the extension should be confined to the present buildings. Unfortunately, the Salisbury Gas Act is in no way exceptional, because it contains more law than common sense.

The principal features of the design shown on the diagram are a moderate first cost and simplicity of connections; there being only six curve pipes, all pipes are above ground, and every joint open to access. During the summer of 1904, the No. 1 house was completely cleared, with the exception of the main valves and connections—the purifying work being meanwhile taken up by No. 2 house—and the site excavated to a depth of 4 feet below the ground level. The foundation was constructed by our own labourers from material furnished on the works, with the exception of the stone chippings. The bottom consists of large blocks of burnt fire-brick and clinker from dismantled retort-settings. The interstices were filled with tar asphalt made with clean limestone chippings, and the surface levelled off with similar material. It was well rolled with a water loaded roller; and on the level platform thus secured was erected the rectangular cast-iron box shown—filling the entire space from wall to wall with the exception of a few inches. The box is divided by a central partition so as to form two boxes, each 27 ft. by 18 ft. by 5 ft. deep. The bottom, side, and partition are made of cast-iron plates with planed joints and all flanges inside. The top plates are strengthened by diagonal ribs and by standards inside, which serve as supports for the bearing bars; and there is a deep flanged neck to take the lids, of which there are two to each box.

The lids are on Green's principle, having a rubber joint in place of the usual water seal, and are 10 ft. by 13 ft. in size. The bottom of the boxes is 3 feet below ground level—it being the lowest point at which a gravity overflow to the tar-well could be secured for the condensed water; otherwise I should have preferred to go another foot lower. There are two four-way valves—one for the inlet and one for the outlet—and the valve-chamber rests immediately on the top plates, which form the bottom of the chamber; and two quadrant shaped openings afford direct communication to each box. In connection with the openings on the inlet valve, a sleeve or pocket extends to the bottom of the box to carry the gas below the lower layer of screens; so there is absolutely no piping between the valves and the purifiers. There are two layers of grids in each box, and each layer will accommodate about 18 inches thickness of material. The space at the sides is filled up solid with tar asphalt. The arrangement of pipes and valves as described is covered by Ramsden and Smith's patent.

This arrangement of apparatus has been in use for some twelve months, during which time about half-a-dozen changes have been made, and has proved entirely satisfactory. The rubber

joint is a great advance on the water seal, and on the whole does not require so much attention; and there has never been any difficulty in getting an absolutely tight joint. Apart from the structural advantages peculiar to the rubber joint, I am so far satisfied with it in working that I would not care to return to the water-seal.

Our Auditors said that they could only put the additional cost of the new plant to capital; but on looking into the question of cost, it was found that whereas the old set displaced afforded 432 square feet of working area and cost £1100, the new set gave 972 square feet and cost £800, inclusive of foundations; so there was a minus quantity of £300 to be disposed of. Part of the cost of the old set was due to the columns and girders required for the overhead system; but allowing for these, there is a marked difference in favour of the plan now described as compared with water-seal covers and underground connections. By burying the boxes to ground level, having all overhead connections, and direct communicating valves, it is possible to secure considerable economy in first cost; and if care is taken to secure a water-tight foundation and dry side packing, there is no serious reduction of temperature during cold weather. If necessary, the top could be covered with suitable non-conducting material. The more equable temperature secured by this form of construction is a decided advantage as regards the working life of each charge.

Discussion.

The PRESIDENT said there were several important matters in connection with this paper for consideration. There was the question of the cost of the boxes, and also the method of sealing by means of the rubber joint.

Mr. A. F. BROWNE (Vauxhall) said perhaps Mr. Humphrys would state his maximum make per twenty-four hours.

Mr. HUMPHRYS: Just about ½ million.

Mr. BROWNE: I thought it would be about that.

Mr. D. H. HELPS (Reading) said he took it that any discussion which might follow the reading of this paper would probably take the line of the relative advantages of water-lute purifiers and those with rubber joints. He would first congratulate the author of the paper on having adopted the latter system. He had recently designed some purifiers for his carburetted water-gas plant. The boxes were only of medium size, some 30 ft. by 25 ft. The covers, which were of the luteless type, were larger than he had ever seen, being 25 ft. by about 14 ft. However, he certainly would not have adopted the luteless form, unless it had been possible to do away with the curtain all round the sides. They had been able to dispense with the curtain, except a piece of cast iron, some 14 inches wide, between the covers. With these covers it was quite possible for the men to ram the purifying material as easily as with a water-lute purifier. There were advantages other than that of cheapness. He thought a box constructed with luteless covers was better able to withstand the internal pressure of the gas. He had heard it said that the lute of a purifier strengthened it; but he thought there was a source of weakness where the lute plate joined the sides of the purifiers. There was one thing that should be remembered when dealing with luteless purifiers, particularly where they were used for carburetted water-gas—that was to arrange for a safety-valve. When one was pumping (say) from the relief holder and driving the gas through the exhauster, unless there was some safety-valve, it would be quite possible to burst the purifiers. He had himself arranged to avoid this danger by taking a pipe off the outlet of the exhauster, and sealing it in the ordinay way in water, so that the seal would blow at an arranged pressure.

Mr. H. O. CARR (Wandsworth) complimented Mr. Humphrys on his paper. Regarding luteless lids, the whole of the purifiers at Wandsworth were of this type; and the size of the boxes was 40 ft. by 36 ft. They had never had the least trouble with these lids. They were fastened down by bolts the whole way round, and they had no rubber joints. The joint was made with hemp gaskin, which had been previously boiled in tallow. Some of the smaller purifiers—they had three of these in all—had been in existence about 25 years now, and only once had the gaskins been changed. They lasted some ten or twelve years. An important item, of course, with luteless covers was their great saving in the matter of capital expenditure. There was a fair saving, which more than repaid them for the extra labour involved in bolting the covers down, because there was no doubt there was a little more labour required to bolt the luteless covers down than with the old water-lute; but, as he had said, it was amply repaid by the capital saving. There was another point of interest to those who had little room to spare. At Wapping, for instance, where he was associated with Mr. H. E. Jones, before going to Wandsworth, the space there was very cramped indeed; and the revivifying-floor there was placed over the purifiers. But there were many hundred pounds saved on account of the less height the revivifying-floor had to be placed over the purifiers, and so there was again a very great advantage. Mr. Humphrys had also remarked in his paper on the question of a suitable non-conducting material for the top of the purifiers when outside. He (Mr. Carr) would like to say with regard to this that he thought, however tightly the purifier-covers were bolted down, any layer of non-conducting material was pretty nearly sure to crack, and the weather would get in, and, unknown perhaps to the manager, rusting would take place under the cover. He thought a better plan to adopt (he had given it a trial, and it worked very well indeed) was an air-cushion—that was to say, a ridge pole was erected over the cover, light scantlings placed at the end of the cover, and tarpaulins put over the whole lot. This made a good warm air-cushion, and was no danger to the purifier-covers. The whole of the purifiers were quite open. There was only one lid at Wandsworth; and he rather thought it was better, and that they could get to the whole purifier better, than splitting it up into a number of lids. There was little trouble in lifting the lids; and if they could get to the whole area of the purifier, they could have it better loaded, and loaded to a greater height that when it was only partly open.

The PRESIDENT remarked that they had with them the President of the Eastern Counties Association (Mr. R. G. Shadbolt), who, he believed, had been using luteless covers.

Mr. R. G. SHADBOLT (Grantham) said he was exceedingly obliged to the President for giving him an opportunity of addressing a few remarks before the Southern Association on luteless purifiers or on any other subject. He could not say that he could pose as an authority on this particular matter; but in his small way (his was only a small country town), their experience was briefly this: Having reason to extend their purifying plant, they did put down two and eventually four luteless purifiers. With a view to handling the covers easily, they split the lids of these small 25 feet boxes into four, and designed a small derrick, which could be shifted about, running upon four broad pulley wheels; and in this way the lids were very easily lifted, and run away wherever wanted. Having a gangway, 2 ft. 6 in. wide, in each direction across each box, enabled this to be done. Even with regard to small works, they found these cross gangways very convenient in connection with the charging of the boxes, because the men could wheel the material across the centre of the box, and put it almost in the very spot where it was required. It did away with the necessity for mechanical aid of any kind. He could not help wondering as he sat there, in regard to the remarks of Mr. Douglas Helps, how it was he found it necessary to put a safety-seal or safety-valve in connection with his plant dealing with the water gas. He (Mr. Shadbolt) did not apprehend any danger in that position. It struck him as curious that it should ever be necessary to have a bursting strain upon the purifiers. He was not before aware that it was necessary in the case of carburetted gas plant to provide safety-valves or safety-seals. There might be some reason for it; and if there was, he should like to know what it was.

Mr. D. H. HELPS, referring to Mr. Shadbolt's remarks, said he thought it was advisable to arrange for a safety-valve on any purifiers, whether for coal gas, oil gas, or (as some preferred to call it) carburetted water gas. Many of the serious accidents that had occurred about the country would no doubt have been prevented if, instead of allowing the water-lute to blow, a safety-valve had been arranged at some point on the inlet, so that gas could have escaped at that point whenever the pressure rose. A water-seal on the inlet of the purifiers was better than allowing the lutes to blow. Supposing a man started up the carburetted water-gas plant with the valves shut, there was the danger of bursting the purifiers; but where there was a safety-seal, no harm could be done.

Mr. A. E. BROADBERRY (Tottenham) said, as they had been using purifiers at Tottenham constructed on this principle for the last nine years, he thought perhaps it would be of interest to the members, if he made a few remarks. He quite agreed with Mr. Humphrys that having adopted this system of purifier, no one would think of going back to the lute system. They had now, with one or two exceptions, the same india-rubber joints in use that they put in nine years ago. They had not given any trouble at all; and so far as serviceability was concerned, he thought they were in as good condition as they were at the start. He quite agreed with Mr. Shadbolt in saying that head-decking about the purifiers was very handy, in forming gangways. No doubt there was a little bit of difficulty in getting the material underneath the decking on the top layer. But the men soon got the knack of doing it; and they found the material was placed on the top layer (by men who had had little experience) almost as perfectly, or quite as perfectly, as in the other parts of the purifiers. He knew that some engineers had an objection to the decking; but personally he had not found any inconvenience from it. As Mr. Shadbolt said, the ability to reach almost any part of the box compensated for any little difficulty there was in getting the oxide or the lime underneath the decking.

Mr. J. W. HELPS (Croydon) said he only rose for the purpose of disagreeing with Mr. Broadberry, who said he had no difficulty in connection with the decking of the purifiers. He (Mr. Helps) must say that he had; and in any further boxes of this sort that he designed, he should certainly do away, as far as possible, with decking. Of course, in disagreeing with Mr. Broadberry, he also took the liberty of disagreeing with Mr. Shadbolt. It seemed to him that the advantage both Mr. Shadbolt and Mr. Broadberry claimed for the decking could be very easily obtained in another way. If they thought it was necessary to do away with the decking, it would be practicable to have a system of wrought-iron or steel joists across the top of the purifier; and nothing would be easier than to lay on these joists planks along which the oxide could be wheeled into position as desired. This appeared to him to be an easier system than fixed decking; and, as a matter of fact, they could get the oxide nearer the position in which they wished to drop it than by the decking. He had lately been round

several new gas-works; and he had been struck with the different practice with regard to these luteless covers. He went to two large works on the South Coast. At one of them, he saw a number of boxes about 30 feet square; and these boxes were each provided with nine little covers. He went on to the other works, where he found some 30 feet boxes with only one cover on. He must say that it appeared to him the system of the one cover was preferable to the several small ones. The only objection that could be raised to the large ones was the slight difficulty in lifting them. It was true that they required a little more lifting than the smaller covers; and the lifting apparatus would perhaps make the plant a little more expensive than if they adopted a system of small covers. The lifting apparatus, however, need only be very simple; and ordinary Morris and Bastard lifting apparatus was very inexpensive. He heard with interest from Mr. Carr that he had been making use of gaskin instead of india-rubber, and that it had lasted a number of years. In his own case at Croydon, they used the flat india-rubber; and they did at first find a little difficulty, as the rubber did not know whether to adhere to the cast-iron bottom or the wrought-iron top. This had, however, now been overcome. Another point in connection with these luteless covers was the simplest form to adopt for screwing them down. There were a number of patents out now, whereby these covers could be screwed down by one motion, instead of using the ordinary eye-bolts which were very common in this system. He did not know which was the best; and experience with these devices would be of some use to those who had to design boxes on this system. He had nothing further to say, except that in his opinion the right way to construct these boxes was without decking.

Mr. W. D. Child (Romford) asked to be allowed to raise the point, in connection with the question of the construction of large covers for these luteless boxes, that where the difficulty came in was in making a cover of such considerable surface sufficiently strong to bear lifting without buckling. They had not the advantage of the dip that occurred in the water-seal cover, which strengthened the outer rim very considerably; and a little difficulty in constructing (say) a 30 or 35 feet cover would be in getting it sufficiently strong to enable it to be lifted at the four points. He thought this was one of the main reasons for dividing the cover into small areas.

Mr. A. F. Browne (Vauxhall) said he agreed with Mr. Douglas Helps in the case he had made out for a safety-seal to the purifier-boxes. He should be very sorry to be without such a thing. It was bad enough when a purifier-box blew in the open; but when the boxes were enclosed within four walls there was great danger. It was such a simple matter to have a safety valve or seal, that gas-works should not be without them. One question he should like to ask the author. It was upon the subject of area. Did he rightly understand that Mr. Humphrys had two 20 feet square boxes and two 27 feet by 18 feet, and did he work three of these and one off.

Mr. Humphrys said he worked all four.

Mr. Browne supposed then it would be fair to take the mean of the area of the large and small boxes, and to say that the purifier area of these four boxes was 0·88 of a square foot—that was to say, dividing the superficial area by the maximum make in thousands. This was an enormous area. He thought that Mr. Newbigging was satisfied with 0·6; Mr. Lewis Thompson Wright with 0·5; and the Beckton rule he believed was 0·4. And now they found here something like 0·9. Well, Mr. Humphrys was to be congratulated upon this, unless he had got the purifiers too big for his present make. He had, he might remark, heard of boxes being too large.

Mr. Carr said he might add to his previous remarks that the purifiers of which he had spoken were all fitted with water-valves; and he thought this provided sufficient safety for any possible over-pressure. He considered there was nothing safer than a water-valve.

The President said there were one or two points to which he desired to allude. When some of the members were at Dorking last June, he was asked about the rubber joints. The difficulty in some works appeared to be that the rubber became detached from the cover. He (the President) had never had the slightest trouble in this way in two-and-a-half years' use. In his case the ratio of adhesive surface (as a drawing he submitted showed) was made as 4 to 3. He examined the rubber only the previous day; and it was as good now as when attached. As to the question of decking, they had not the slighest trouble whatever. It certainly was a great convenience to have decking at any rate on purifiers 20 feet square. In his case, all the covers were 20 feet by 15 feet. So that even with 30 feet purifiers, it was possible to do with two—certainly not more than two—covers; and it considerably reduced the cost of the purifiers. In his case, Milbourne's rapid fasteners were used, by which the covers were attached very rapidly. If the purifier was thrown out of action in the summer, and then put into action again (say) two months later, they could tighten up the adjusting-screws in three or four minutes.

Mr. Humphrys, in reply, thanked the members for the kindly reception they had given to his paper. There were, he said, only one or two points in the discussion to which he need reply. First with regard to the safety-seal. This had been out of question with him for some years, because it happened his purifier-house was situated in a somewhat isolated place, some distance from the retort-house where the men were at work. They put in a safety seal (which would blow at a pressure some few inches below the depth of the water lutes), not in the purifier-house, but down near the exhauster-house, where it would attract attention, so that it did not matter what form of cover they had in the purifier-house, the seal would blow down by the exhauster-house in the open air, where the gas could get away without doing damage, and at the same time would attract the attention of the retort-house men. Regarding decking on the luteless boxes, they found no difficulty in getting the material loaded up level and evenly. They threw it a little higher in the corners, so as to prevent any risk of blowing through round the sides. Mr. Browne said the area of the purifiers was somewhat large. This rather reminded him of the story told by one of the Christy Minstrels of the negro who ordered some shoes at a certain price, but did not stop to be measured. When the shopman asked him about his measure, he replied "Never mind about that; make them as large as you can for the money." This was something of the principle that he (Mr. Humphrys) went on with regard to these boxes. They had the building; and they filled it. (Laughter.) Mr. Browne was quite right about the 0·9—at present. But the consumption at Salisbury was going up, in spite of the electric light and other things, at the rate of 5 per cent. per annum; so that he had every hope that in a few years they would fall something like into line with Mr. Browne's ideas of what the area of the purifiers should be. Following the usual plan in carrying out extensions, he provided for the future. In regard to the rubber joint it was simply well greased and laid on the flange; and then when the cover was lifted away, they simply rolled the rubber up, and put it into a barrel, so as to keep it free from dirt or anything of the kind. So far as he could see, the rubber would last for twenty years or more; it showed no signs of wearing yet.

Mr. R. Herring (Dover) read the next paper, which was entitled—

A HIGH-SPEED EXHAUSTER FOR PRESSURE-RAISING IN GAS-MAINS.

Before describing this high-speed exhauster, I will very briefly explain why it was adopted. The district pressures are controlled by three governors—one at the works, and one at each of the gasholder stations in Dover. These holders are 1½ miles distant, and 85 feet lower than the works. For some considerable time, great difficulty was experienced in maintaining a sufficient supply to these during the period of maximum consumption; it could only be done while the works holders were giving full pressures.

In December, 1903, and January, 1904, the trunk main from the works to these holders was tested, to ascertain the pressures given at different points and the quantities of gas delivered. This main is 14 inches in diameter, and is only used for conveying gas to the town holders. While the maximum pressures were available, all went well; but when the holders at the works were uncupped, the pressures fell to 60-10ths, and the minimum to 45-10ths. Then the consumption exceeded the supplying capacity of the main, and frequently the holders had very little in them. On these occasions, the pressures were reduced on the town governors and increased at the works, where we had ample stock. By working in this way, the whole district pressures were maintained; but one can easily imagine that it was a very anxious matter for all concerned.

My Directors saw the urgency, and decided that something should be done to ensure an improved supply to the town holders; and in February, 1904, I was asked to report upon the best method to accomplish this, and at all times (if required) be certain of an ample stock in them. Two ways engaged my attention—the substitution of a larger trunk main, or by some mechanical means to increase the pressure in the existing one. After making careful inquiries, the Sturtevant Engineering Company, of London, assured me that their high-speed gas-exhauster, directly geared to a De Laval steam-turbine, would fulfil the conditions I asked.

This being a new departure in gas-pressure raising, and the first gas-exhauster directly geared to a steam-turbine, I could not easily decide as to its suitability for the purpose; but the Company were confident it would be successful. With this assurance, I recommended my Directors to adopt the plant; and in March, 1904, an order was given them to carry out the work. This being the pioneer installation of its kind, numerous and prolonged experiments were conducted at the makers' works before it was completed to the satisfaction of them and myself.

On Nov. 1 last year, the plant was put into operation at the Dover works; and it has been working when required until the 6th inst. On the latter date, the turbine wheel and bearings were removed, and a duplicate set substituted. During the period named it was not repaired; and the examination on Monday last revealed no trace of wear in either the shaft or bearings. The arrangement has always worked well and to my entire satisfaction; and the promises of the makers have been fully realized.

The turbine runs at a very high speed—32,000 revolutions per minute, directly geared to the exhauster running at 4000 revolutions per minute—and increases the holder pressures 120-10ths. It is geared down eight to one; the usual practice being to gear up. The advantages of gearing-down will be easily recognized.

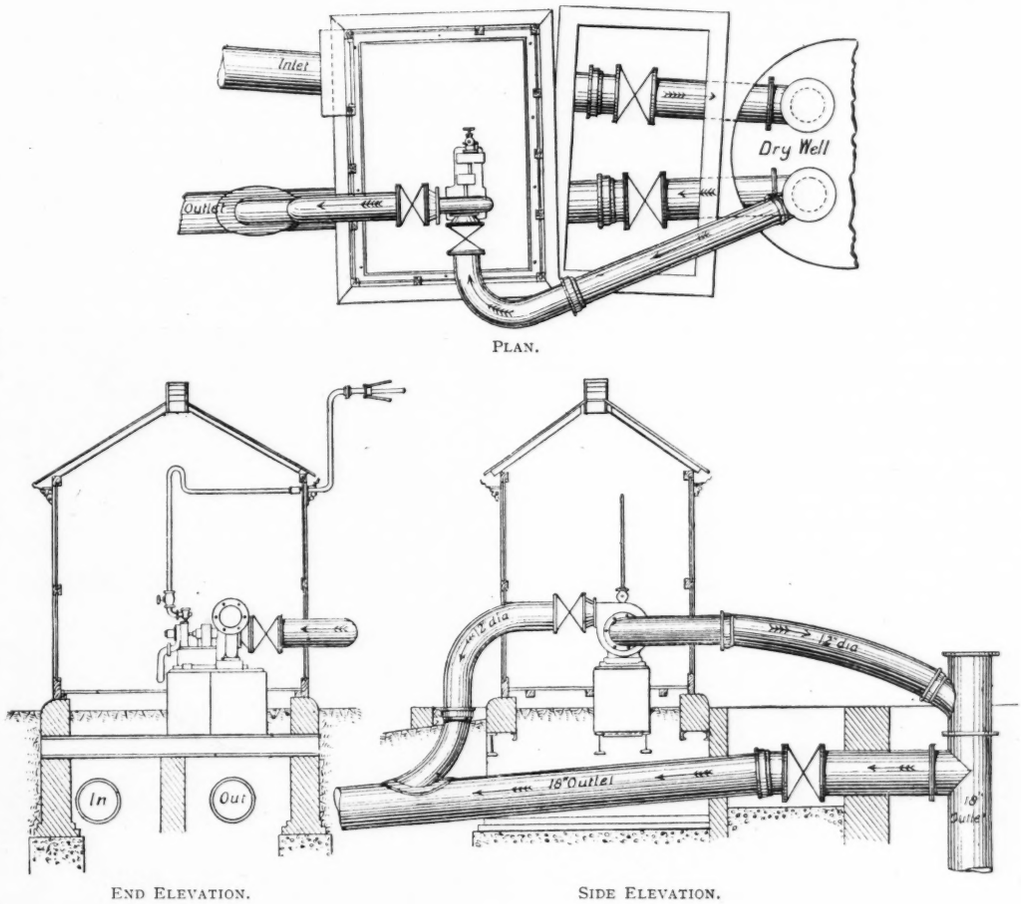
The plant has a working capacity of 2,250,000 cubic feet per 24 hours; the floor-space occupied being 36 inches by 20 inches. The connections are 12 inches in diameter; the whole apparatus being installed in a small room 10 ft. by 7 ft. 6 in. This is quite large enough for a 5 million cubic feet set.

From the foregoing particulars, it will be observed that the machinery is exceedingly compact, and also very light considering the work done. The total weight of the complete plant, including the bed plate, is 7 cwt. 0 qr. 20 lb. Compare this with an ordinary plant of the same capacity, in which the flywheel alone weighs more than this complete high-speed apparatus. The moving parts of the turbine are the wheel-shaft and pinion; the total weight being 2 lbs. 6 oz. This, for a 5 brake-horse-power engine, is less than ½ lb. per horse power. The turbine-wheel is 5 inches in diameter, the pinion 1 inch, and the smallest part of the shaft $\frac{3}{16}$ inch—all made from high-grade steel, perfectly finished. It is a splendid example in every way of accurate machining—especially the double helical gearing, which runs at a circumferential speed of 30 yards a second. When this was examined on Monday last, I could not detect the least signs of wear in any part. I may mention that the makers of the turbine were Messrs. Greenwood and Batley, of Leeds.

As previously mentioned, I have the shaft and other parts of this machine, as well as photographs and plans of connections, for the members' inspection.* Also a shaft for a 1½ brake-horse-power turbine, which looks like a well-finished model, but is actually part of a practical working machine constructed to run at 40,000 revolutions per minute, geared to a 20,000 cubic feet per hour gas exhauster. This is the smallest size made for gas-pressure raising.

The exhauster is made of thin sheet steel 17½ inches diameter, mounted on a shaft 1 inch in diameter; and the speed is 4000 revolutions per minute. At my suggestion, this was fitted with a bearing on the inlet side. Previously, they were overhung. By its adoption, higher speeds are possible, and absolutely steady running ensured. All the Sturtevant exhausters are now thus fitted. The action of the exhauster is mainly centrifugal, not forcing. Small volumes of gas are impelled at high velocity—670 discharges per second. When working at this speed no harm results, nor is there any increase in the pressure if the valves are shut—quite the reverse. Automatically the speed is controlled, and the required pressure maintained. This shows the gas to be impelled, not forced, as the exhauster continues running in the contained gas between the obstruction and the holder. Working under these conditions, telephonic communication is not needed, nor is it used. The valve man's instructions are during specified hours to keep the holders full. This is now easily done by adjusting the valves according to consumption.

The exhauster can be used as a bye-pass. I have diagrams (p. 464) showing when this was done. The portion marked A is



PLAN.

END ELEVATION. SIDE ELEVATION.

THE STEAM-TURBINE DRIVEN GAS-EXHAUSTER AT THE DOVER GAS-WORKS, FOR INCREASING THE PRESSURE IN THE MAINS.

gasholder pressure; B the exhauster used as a bye-pass; and C the intensified pressure. The 12-inch exhauster connections are branches taken from the 18-inch gasholder outlet, one on each side of the original valve, which is shut when the turbine is working, when it then serves the purpose of a bye-pass. I wish to point out that the inlet to the works governor is from the 14-inch high-pressure main to the town holders; the latter supplying the town governors.

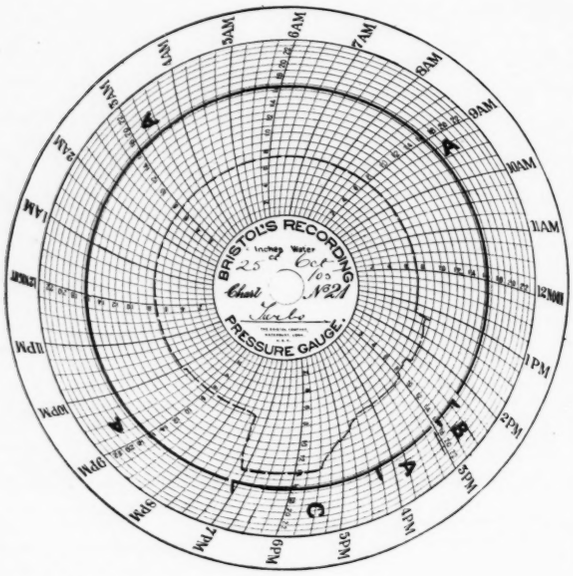
In the charts for Oct. 25 and 26, three pressures are shown. The portion up till 2.30 p.m. is gasholder pressure. From 2.30 to 3 p.m. is the exhauster and connections used as bye-pass in the course of regular work—*i.e.*, supplying works governor and filling town holders; and it will be noticed by so doing there is only a loss of 5-10ths pressure. Ordinary gasholder pressure follows until 4.15 p.m., when intensifying commences. The maximum pressure, 140-10ths, is reached at 5.30 p.m., and maintained till 7.15 p.m.; and at 7.30 p.m. there is a gasholder pressure of 65-10ths.

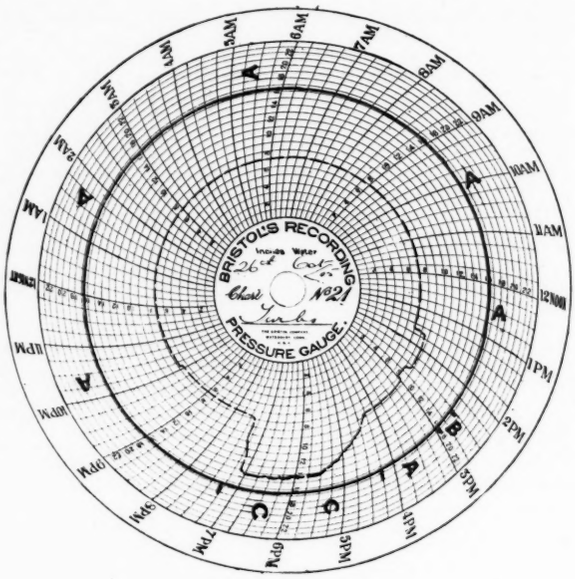
These diagrams are taken direct from the outlet; and it will be seen what a steady pressure is obtained. The enormous speed absolutely prevents oscillation.

By compounding the exhausters, any required pressure in gas-works could be obtained; and with the many advantages they possess over the ordinary type, I shall expect them to be largely adopted for gas making. I have every confidence, after twelve months' experience, in their reliability for this purpose, and when the occasion arises shall advise my Directors to apply them.

The following tables show some working tests. A is solely hourly quantities passed on Dec. 2, 1904. B is a table of one week's working in October this year, showing steam pressure, speed of exhauster by tachometer, and gas pressures. The

* We reproduce to-day the plan referred to, as it appeared in the "JOURNAL" for Dec. 13 last year, p. 841; also the photographs of the turbo-exhauster house and the Sturtevant intensifying plant—referring readers to the issue of the "JOURNAL" named for other photographs and particulars.—ED. J.G.L.





speed does not always indicate the quantity of gas passing; this depends upon the valve aperture at the town holders.

Steam is obtained from a vertical tubular boiler, having a working pressure of 120 lbs. per square inch. Numerous tests for fuel consumption have been made at different times; and the results have always been highly satisfactory. The average quantity works out at $14\frac{1}{2}$ oz. of coke (including that used for daily lighting of fire) per 1000 cubic feet of gas compressed.

TABLE A.—*Hourly Quantities of Gas Passed through Exhauster. Friday, Dec. 2, 1904.*

Time.	Quantity. Cubic Feet.	Time.	Quantity. Cubic Feet.
3 to 4 p.m.	40,000	6 to 7 p.m.	100,000
4 ,, 5 ,, ...	90,000	7 ,, 8 ,, ...	85,000
5 ,, 6 ,, ...	90,000	8 ,, 9 ,, ...	81,000

TABLE B.—*Speed Tests of Turbine and Exhauster.*

[A. Steam pressure, in pounds. B. Tachometer readings of exhauster, in revolutions per minute. C. Gas pressure in tenths.]

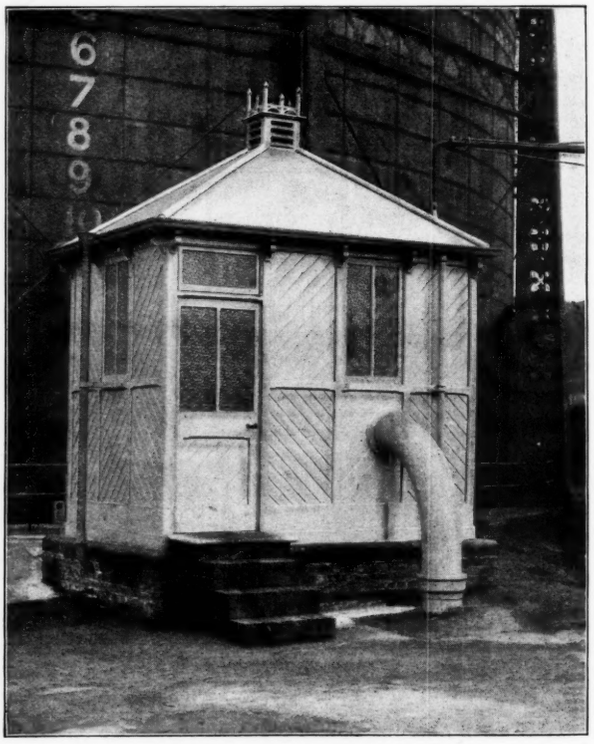
1905.		3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.
Oct. 23 . .	A	105	105	105	105	105
	B	2120	2120	2520	3080	3600
	C	115	115	120	140	140
,, 24 . .	A	100	100	105	104	105
	B	2080	2080	2200	3080	3000
	C	120	120	120	140	140
,, 25 . .	A	Exhauster connections used as bye-pass		109	106	105
	B			2120	3080	3080
	C	85	85	110	140	140
,, 26 . .	A	Exhauster connections used as bye-pass		96	100	101
	B			2400	3080	3080
	C	85	85	120	140	140
,, 27 . .	A	105	100	105	104	100
	B	2120	2120	2680	3360	3400
	C	120	120	130	140	140
,, 28 . .	A	100	105	108	105	108
	B	2080	2120	2760	3400	3400
	C	120	120	130	140	140

In conclusion, this plant differs so much from that usually found in gas-works, and some of my remarks may have appeared so difficult to realize—especially those in connection with speed and light weight of moving parts—that I decided to bring some portions, including the buckets of the turbine-wheel. The plant was installed by Messrs. S. Cutler and Sons.

Discussion.

The PRESIDENT said he was sure the members thanked Mr. Herring very sincerely for taking such great pains in preparing his paper, and in providing them with models. There was just one point that occurred to him (the President), and that was the very low expenditure named—0·6d. If these exhausters could be adapted to the exhaustion of gas from the hydraulic main, and a steady vacuum obtained, there was not the slightest doubt they would get a higher make per ton. What they wanted was a dry main, and a steady exhaust.

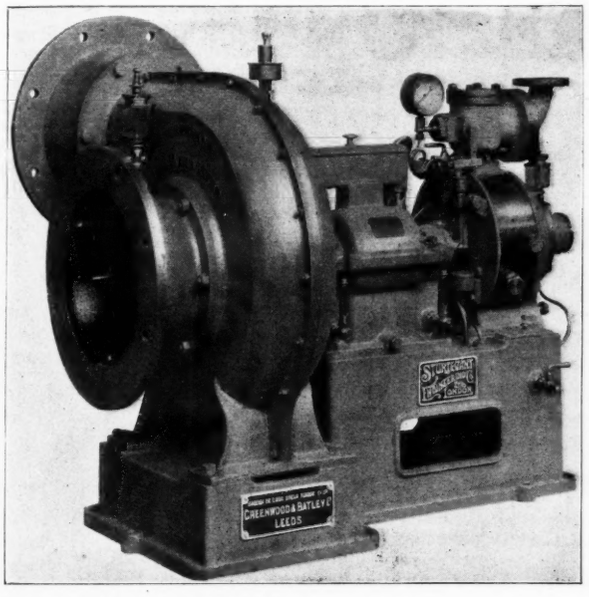
Mr. A. E. BROADBERRY (Tottenham), while heartily thanking Mr. Herring for the care he had bestowed upon the preparation of the paper, said he must say straight away that he had to let him down with a pretty heavy bump on one point. Mr. Herring appeared to think his installation of a De Laval steam-turbine, in conjunction with a Sturtevant exhauster, used for boosting purposes in gas-works, was the first of its kind. He (Mr. Broadberry) put one of these plants in three years ago. It was in use just about two years before Mr. Herring set his to work; so that he was afraid the Sturtevant Company did not post Mr. Herring with the fullest information when he was making his arrangements. As he (Mr. Broadberry) had said, he had had three years of this kind of work; and he could quite agree with the author that nothing could work more sweetly than the steam-turbine and the gas-exhauster combined. So long as



THE STEAM-TURBINE EXHAUSTER-HOUSE AT DOVER.

the steam-pressure remained steady, they could rely upon getting very steady pressures on the outlet of the booster. Their system at Tottenham since they had adopted this—it was hardly what he could call high-pressure distribution, but it was increased pressure distribution—had been to send gas out to central districts within the Company's area by mains free of all connections. From these central points, the gas distributed itself into the distribution mains proper; and it spread from these central points towards the outskirts of the district. The works being on the outskirts, although they were the source of supply, they had the advantage of being able to bring a pressure-pipe

back into the governor-house, so that they could see not only the initial pressure on the different leading-mains, but also the pressure at the extremity of the district, so far as the portion next the gas-works was concerned. Therefore, by means of this pressure-gauge on the extremity of their distribution system, they were able to ascertain what effect they were producing with the pressure they were letting out into the trunk mains. On one main—an 18-inch—which delivered gas into the centre of Tottenham, a little over a mile from the works, they generally kept a pressure of about 10½ inches; and they kept the same pressure, of course during the hours of heavy consumption only, on the 24-inch main which delivered near Wood Green, about 2½ miles from the works. These high pressures were, of course, reduced somewhat during their travel; and they distributed themselves in the ordinary mains at between 5 and 6 inches pressure. They found by these means that they were able to supply parts of the district which were formerly starved for pressure without having to go to the expense of laying large additional trunk mains; and it was a system he would recommend to his brother engineers whenever they found themselves in similar difficulty. With regard to the working of the turbine, it ran so gently and smoothly that, when they put their first one up over three years ago, they simply had the exhauster supported by the cast-iron connections, and a wooden prop underneath the base-plate of the combined exhauster and turbine. This was all the foundations it had to run on. It was running, in fact, about 8 feet up in the air. It ran perfectly, without any vibration. During the whole of the three years, the only breakdown of any description they had had



THE INTENSIFYING PLANT.

was that a bolt got loose in the chamber in which the turbine wheel itself ran. It fell foul of the wheel; and as the wheel ran at 23,000 revolutions per minute, it did not do the wheel any good; and it bent the tiny shaft, which was about ⅜ inch diameter. The makers were very good over the matter. When he telegraphed to them, they sent a man specially up from Leeds to put in another shaft, and did not make any charge for it. The turbine therefore had run for over three years without a penny of expense, so far as renewals were concerned.

Mr. J. W. HELPS (Croydon) said he had had to go into this question of pressure-raising lately, and principally for the reason that had been mentioned by Mr. Broadberry—that was the need of increased pressure in the town. There was one other point which should not be forgotten when speaking of the advantages of this system. It was that at present they found it was practically impossible to give anything like the pressures at the governors necessary for the distribution to the town, unless the gasholders had their three lifts in use. It therefore amounted to this, that their storage was only a nominal one; and only a certain proportion of it—not more than half—was really available at the times they most wanted it. So they were about to put down a plant such as Mr. Herring described, which would render it possible to make the storage not only nominal but actual, because they would be able to get every foot of gas out of it by means of this apparatus. He (Mr. Helps) had been considering this question for a long time, and had been hesitating as to what form of plant he should adopt. He had finally determined to have a De Laval steam turbine and Sturtevant blower. But he must honestly say he was somewhat disinclined to do this, because he saw an apparatus in the North of England which he liked very much better. He had been to the Provan works of the Glasgow Gas Department; and there he saw an apparatus at work which pleased him immensely. It was a Parsons steam-turbine, working a Parsons gas-turbine, which was simply a steam-turbine turned round so that the inlet became the outlet. He came away almost determined to adopt it. But on further consideration, he arrived at the conclusion that it was too much of a positive machine; and one could not help thinking what disastrous results would attend a breakdown at a time when they found it necessary to increase the pressure very much at night, unless they adopted some sort of bye-pass with a special self-acting arrangement. This turbine was only about 13 inches in diameter and worked on a 30-inch main, and, of course, the parts inside filled up the space to some extent. If, therefore, only momentarily the machine stopped, the bye-pass in the machine itself (which, in Mr. Herring's case, was only responsible for a loss of 5-10ths), in this case would be responsible for a very much greater loss. He came to the conclusion that, if he adopted a Parsons turbine, beautiful as was its action, he should be compelled to put down expensive self-acting apparatus, which would open and allow the gas to be bye-passed in case of a breakdown. Therefore, he determined to adopt a De Laval turbine and a Sturtevant blower. A great point one had to consider was to put down a machine large enough. He knew that Mr. Browne's experience at Vauxhall in connection with this matter showed that it was very difficult to work these machines up to their nominal capacity; and anyone who was thinking of putting down a plant of this sort, he should strongly recommend him to put it down large enough.

Mr. W. D. CHILD (Romford) said he only wished to say a word as to the reliability of the De Laval turbine. He had been running one since November, 1901, without requiring any ordinary repair to any of the working parts. The only mishap in the four years' running was, in starting the turbine on one occasion, the engineer in charge put it at its highest speed before the exhaust-pipe was properly clear of water, resulting in a slight bending of the flexible shaft. He wired to the makers an account of this. They wired back: "Do not attempt to repair it; we have sent you another shaft and turbine wheel." It was put in without any trouble at all; the exchange being simply effected. This was the only trouble he had had with the plant in the four years.

Mr. A. F. BROWNE (Vauxhall) said this was a most interesting paper. The members knew that Mr. Herring had been one of the first to adopt this new way of driving fans. The fan they all knew was not a new piece of apparatus in gas distribution. He believed that the first fan was put in by Mr. Carpenter at Kennington some years ago, and that Sir George Livesey was the originator of the idea. He saw the fan, and thought it might be adapted to gas purposes. At the Kennington station, they had some six of these fans working in the winter. Three of them were driven by high-pressure steam-engines, and the others by gas-engines. There was this safeguard in connection with the Sturtevant fan, that, if the engine stopped, the lights did not go out. If they were working at full pressure and the fan stopped, the pressure might fall some inches at the distributing stations; but the supply was kept up to the district. He was not, therefore, surprised that Mr. Helps (who was kind enough to ask him, Mr. Browne, one or two questions when he was contemplating what he should introduce in this way at Croydon) had finally decided on the adoption of this fan for the sake of safety. The Sturtevant fan was also the safest, so far as he (Mr. Browne) knew, that could be adopted for this purpose—not only because it constituted an efficient bye-pass, but because it could not exceed the maximum pressure which it was designed to effect at its specified speed. Therefore, when these fans were working on the inlet of the governors, one might feel sure the governor seals would not be blown out, however rapidly the consumption might reduce. If they shut the outlet, the fan ran as sweetly as before, and the gas slipped back. Regarding the question as to whether the steam-turbine was a great advance upon the method hitherto employed for driving the fans, he was strongly inclined to think that it was. It was unfortunate the Parsons steam-turbine and blower combination was not quite so safe. Mr. Wilson, of Glasgow, used the arrangement, as Mr. Herring did, for transferring gas from one works to another into a gasholder; and Mr. Wilson told him (Mr. Browne) that he had also used it on the district. Mr. Helps had pointed out that he did not feel quite safe in this direction; and he (Mr. Browne) thought he was quite right in pausing. As Mr. Helps had said, the gasholders in the winter, working necessarily under varying conditions of pressure, would in these days of large consumptions be practically useless to them at the heaviest times of consumption when the highest pressures were wanted. If it were not for these aids, they could not get on at all at Kennington. They had one arrangement (which was perhaps now out of date) of two fans working tandem. The one fan put up the pressure to about 13 or 14 inches; and the other took up the gas from the outlet of the first fan, and raised it further to a total of 21 inches. He was working 21 inches water column, and delivering gas to the heart of a certain district in just the same way as Mr. Broadberry was working. The fan was a highly effective, useful, and comparatively cheap way of supplying increased pressures to various parts of the district. He supposed the whole thing was a half-way house to something else. Perhaps in a few years they would find themselves supplying gas at higher pressures. It was a very useful half-way house. But in these things they must proceed carefully and slowly.

Mr. R. H. ANGIER (Engineer of the Sturtevant Engineering

Company), invited by the President to speak, said his knowledge of the gas industry was practically *nil*, except so far as the use of centrifugal fans was concerned. The first point to which he would refer was the effect produced by shutting the valves used in connection with a fan. At a certain speed, a given fan would throw a certain maximum pressure, and no more. This pressure was partly determined by the construction of the fan, but its speed was invariably the dominant factor. Starting with the valve closed, the effect of opening it was to cause a slight diminution of pressure—the fan then delivering gas through the opening. Speaking from memory, the Dover plant was proportioned so as to increase the gas pressure between inlet and discharge of fan by about 100-10ths, when running to speed, the density of the gas being 0·45. Under these conditions, the fan delivered the volumes which Mr. Herring had given. If now the valve were shut, the pressure would rise to the extent of about 20-10ths; so that the maximum pressure would be about 120-10ths, and never any more. Another important advantage of the centrifugal fan for gas-works purposes was that it automatically delivered the exact volume required by the consumption of the moment—the speed remaining constant. This was naturally not the case with an exhauster of the rotary or piston type. Mr. Browne had mentioned that at one time they (the Sturtevant Company) had misled him to some extent by stating that, if the fan threw a certain maximum pressure with closed discharge, it would do all that was required. He believed he was within the mark in saying that this information had been given a considerable time ago. [Mr. Browne assented.] Their knowledge of fans had progressed since that time; and at the present moment, they would not have given the information in that particular form.

Mr. Herring said while he appreciated much of Mr. Broadberry's statement, he could not thank him for his opening remarks. He thought the whole fault rested with Mr. Broadberry. If he adopted these progressive methods, and kept them in the dark, he must expect someone to take the credit for being first in applying them. At the present moment, it was not decided who was the inventor of coal gas; and after Mr. Broadberry's statement, he had no doubt they would have a lot of people saying they used Sturtevant exhausters years before they were put in at the Tottenham Gas-Works. (Laughter.) It was very necessary on occasions like this to make a positive statement, if one wanted to get a positive reply. He was glad to learn that Mr. Broadberry instead of himself was the pioneer in this movement. He supposed he might take it for granted that Mr. Broadberry's turbine was directly geared with the exhauster. ["Yes."] That was all right; and he hoped Mr. Broadberry was perfectly satisfied with it. ["Yes."] Then he thought it a pity that it was not made known until now.

Mr. Broadberry: It was mentioned in the "Journal."

Mr. Herring (proceeding) said that Mr. Helps called these things "fans." They were not fans when applied to this particular use. The exhausters now used in gas-works were only called exhausters. They were pumps, and they could not exhaust. If they did, the results would be very disastrous; and indeed that had happened. (Laughter.) Nor was this a force plant in any way; and if it was more generally adopted, he was sure it would be given a new name. If this plant were properly described, it would be called a "gas impeller"—not an exhauster; it could not exhaust, and it could not force. The action of it was so totally different from any exhauster now in use, that it would be wrong to call it an exhauster. Under conditions such as he had described, no harm could come from the use of this plant. They certainly could not over-exhaust with it, and they certainly could not force, as the least obstruction put it out of action.

The President remarked that the paper had been an interesting one, and they had had a very instructive discussion on it.

Mr. R. M. Couper (Brentwood) then read a paper, entitled "An Experience in the Reconstruction of Works." This, with the few remarks to which it gave rise, will be published next week.

Thanks to the Authors of Papers.

Mr. A. F. Browne proposed a vote of thanks to the readers of the papers. He said it was long since they had had such a pleasurable and profitable afternoon; and they must congratulate the Hon. Secretary that he had determined to go out of office in such a blaze of glory, as well as the members who had contributed to it. He could only hope that other members would as generously support the new Hon. Secretary, when the occasion came round. Mr. Humphrys had given them a most interesting paper. His name was a household word in the gas industry upon most questions of the day. He (Mr. Browne) congratulated him upon the size of his purifiers, and that he had now quite sufficient purifying capacity for twice his make. Mr. Herring had given them an interesting paper on an important subject. He would find great assistance from the plant, which he was one of the first to adopt. He must also congratulate Mr. Couper upon his very candid and humorous paper. No doubt if Mr. Couper had had a sufficiently large site and virgin soil placed on his hands, he would have been able to erect works at a much lower figure than he had been able to reach this time.

Mr. J. Terrace (Tottenham) seconded the motion; and it was very cordially agreed to.

This concluded the business; and "high tea" was immediately afterwards served.

REMOVAL OF NAPHTHALENE FROM COAL GAS.

By Alfred H. White and David H. Clary.

[Paper presented at the Meeting of the Michigan Gas Association.]

(*Concluded from p.* 393.)

Appendix II.—*Methods of Sampling and Analysis.*

The method used for collecting the samples of tar and gas from the various works visited was essentially the same as that described in last year's paper.* A glass tube about 6 inches long containing fibrous asbestos and glass wool, a bulb tube containing picric acid solution, and a calibrated aspirator were placed in series, and the gas drawn through the system at different rates, depending on the point of sampling. For the stand-pipe samples, most of which were drawn 4 or 5 inches from the top or on the bridge-pipe, an aspirator of about $\frac{1}{4}$ cubic foot capacity was used, and the gas was drawn into it at a rate of about $\frac{1}{2}$ cubic foot per hour. The weighed tube containing asbestos and glass wool was inserted in the hole tapped in the pipe, so that the greater portion of it was outside; this being necessary on account of the high temperature of the gas at this point. When the tube was placed inside the pipe, it was found that a good deal of tar and oil passed the filter uncondensed to the picric acid bulb tube. For samples at all points except the stand-pipe, a cubic foot aspirator was used; the time of drawing a cubic foot of gas being two or three hours. Tar-tubes in all these samples were placed inside the main, because in that instance the samples collected would be more comparable to the conditions actually existing in the mains than otherwise.

The analysis of the tar collected in the asbestos filter was conducted as follows: The tube now containing tar and water incorporated in the asbestos is weighed; this giving, by difference, the weight of tar and moisture collected. The contents of the tube and (if the tar sticks to the glass) pieces of the glass itself are put into the volatilizing-tube, which is then weighed. It is placed in series with the drying-train and the naphthalene U-tube, the arrangement of which is shown in fig. 2, and the whole set in the

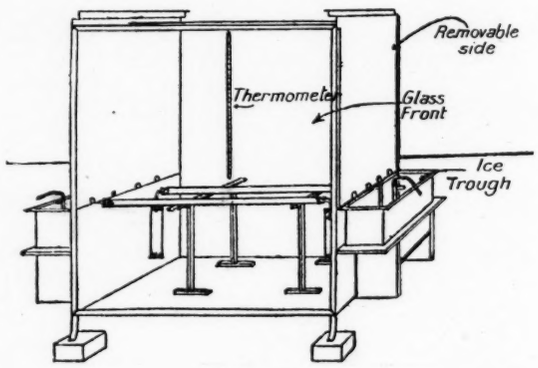


Fig. 1.

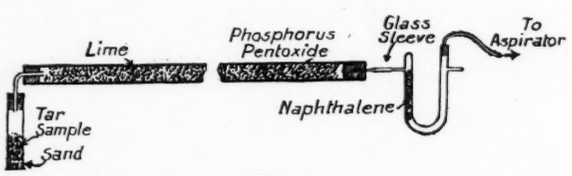


Fig. 2.

oven shown in fig. 1. The oven is heated to 70° to 80° C. (158° to 170° Fahr.), and air slowly drawn through the system, volatilizing the naphthalene and moisture in the tar. The moisture is taken up by the dryer (lime and phosphorus pentoxide), while the naphthalene passes on to be frozen out in the U-tube placed directly outside the oven in a trough containing ice water. The analysis is complete when the weight of the naphthalene U-tube becomes constant, or very nearly so, at consecutive weighings after an interval of two or three hours. The time required for an analysis varies with the amount of tar in the sample, and usually takes 30 or 40 hours for stand-pipe samples when the weight of tar amounts to 8 or 10 grammes. When the analysis is complete, the volatilizing-tube is again weighed; the loss giving the weight of moisture and naphthalene given off. Having the weight of naphthalene in the U-tube, we have the weight of moisture also, which, however, is at best only approximate, because there are always, more or less, light oils, such as benzol, given off from the tar with the moisture and naphthalene, which we have at present no means of determining. Finally, the volatilizing-tube is set into a Soxhlet extractor, and the remaining contents extracted with chloroform until free of all soluble material. After drying,

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* See "Journal," Vol. LXXXVIII., p. 262.

The Nuneaton Gas Company's Specialities.

(HELPS' PATENTS.)

THE MAINTENANCE QUESTION SOLVED!

Ecliptic Fittings are the World's Best Fittings.
A 100-Candle Power Light for 10 Hours for One Penny.

THE MOST ARTISTIC. .
THE MOST EFFECTIVE.
THE CLEANEST. . . .

CONSUMPTION—
1 foot per Burner per hour.

EFFECT—
30-Candle Power.

COST—
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All Air Inlets clear of the Products of Combustion. All Tubes act as Anti-Vibrators. Mantles easily last 12 months. Air and Gas adjustments to each.

The only Flexible Tube Pendant that allows of a central position.
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Pendant Fitting No. 1002.

This Pendant can be made for any size flexible tube, and is most suitable for Churches, &c., enabling the fitting to be adjusted in any way without the aid of steps or ladders.

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All Nipples instantly removable.

Maintenance of Burners a question of Seconds only. 5/- per annum per house will keep all Fittings in order and supply Glass and Mantles.

Made in Styles and at Prices to suit The Palace, The Cottage, and The Workshop.

For Special Glass and Mantles or Bijou Glass and Mantles.

Price of the "ECLIPTIC" Fitting No. 1001, with movable Nipple Plug, Exclusive of Glass and Mantles, but including Plain Flexible Tube and Ceiling Plate, 3-Light £2, 5-Light £3.

"ILIVE" Rise and Fall Pendant, Fitting No. 1002, in lieu of Plain Tube, 15/- extra.

"ILIVE" Rise and Fall Pendant, Fitting No. 1002, alone with 6 Feet of 3-16 Flexible Tubing, 17/6.

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This Rise and Fall Pendant is made for the Workshop in black at Special Prices per Dozen Lots.

Finished Bright, Antique Brass, Antique Copper, and Oxidized Silver at usual Extra Charges.

PATENT ECLIPTIC FITTINGS.

Showing Method of Removing Nipple Plug, and Testing or Adjusting same.

Fitting No. 1001.

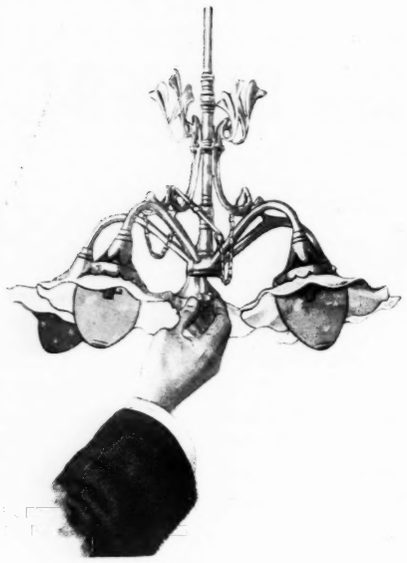


Fig. I.

Fig. I.
Removing Nipple Plug.

Fig. II.
Fixing Test Tube for testing and adjusting Nipples.

Price of Test Tube,
2s. 6d.

Fitting No. 1001.

Fig. II.

Fitting No. 1001.

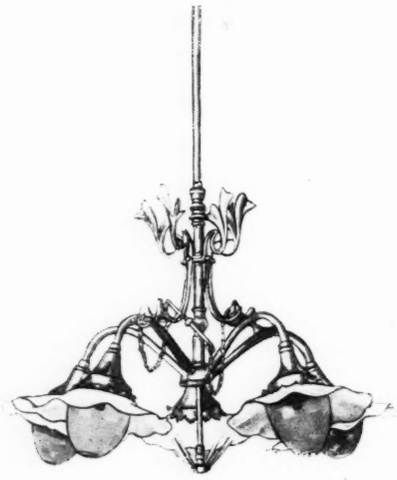


Fig. III.

Fig. III.
Test Tube Fixed showing Flames issuing from Nipples.

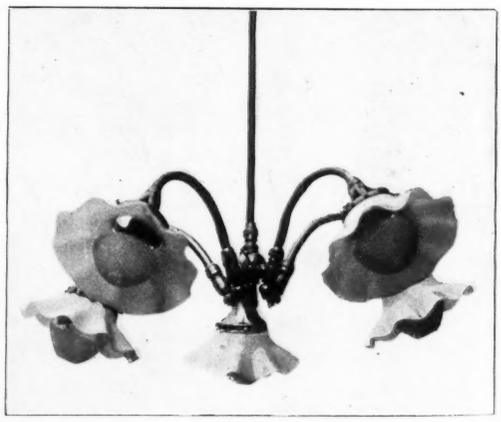
MAINTENANCE MADE EASY.

A study of these Figures will show how it is that Five Burners can be adjusted or cleaned in Two minutes.

Fitting No. 3301.

With separate Cock, Air Adjustment, and Movable Nipple Plug to each Burner.

(Patent applied for.)



The Method of detaching Nipple Plug of Fitting No. 3301 will be understood from print showing Plug removed from Bracket and Pendant, page 4.

PRICES.

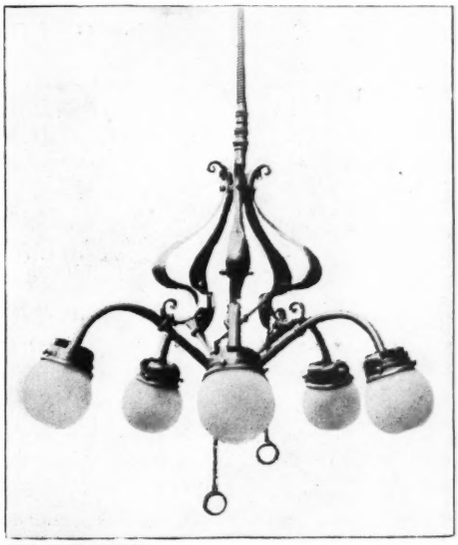
No. 3301, 3-Light Fitting with Cock, separate Air Adjustment and a movable Nipple Plug to each Burner, with Brass Flexible Tube and Ceiling Plate complete, exclusive of Glass and Mantles— **£1 15s. 0d.**

No. 3301, 5-Light Fitting, with Cock, separate Air adjustment, and a movable Nipple Plug to each Burner, with Brass Flexible Tube and Ceiling Plate complete, exclusive of Glass and Mantles— **£2 17s. 6d.**

Supplied also with Plain, Stiff, or Ornamental Down Rods, and finished Bright, Antique Brass, Antique Copper, Oxidized Silver, &c. Other Clusters at proportional prices.

PATENT ECLIPTIC FITTINGS.

Fitting No. 3201. 3-Light.

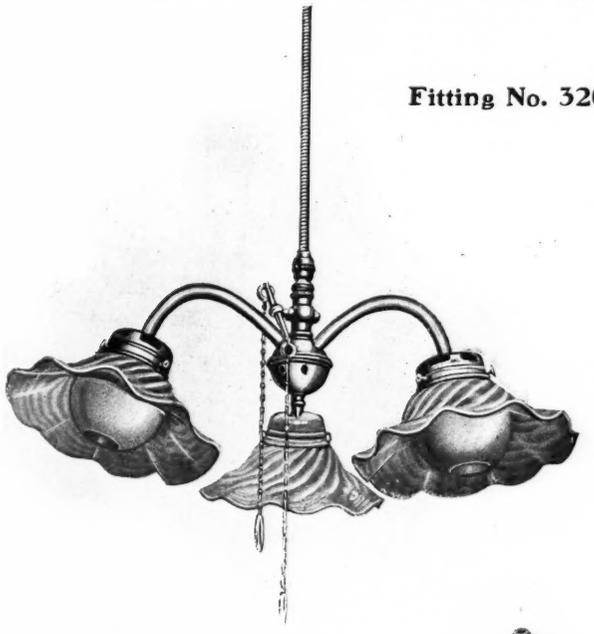


Fitting No. 3201. 5-Light.

NIPPLES CAN BE ADJUSTED OR EXCHANGED INSTANTLY.

PRICES:—3-Light Fitting, with Brass Flexible Tube & Ceiling Plates complete, exclusive of Glass & Mantles, **£2.**
5-Light Fitting, with Brass Flexible Tube & Ceiling Plates complete, exclusive of Glass & Mantles, **£3.**

Supplied also with Stiff, Plain, or Ornamental Down Rods.
Finished Bright, Antique Brass, Antique Copper, and Oxidized Silver at usual Extra Charges.



Fitting No. 3200.

Registered No. 450,732.

PRICES:—3-Light Fitting, with Brass Flexible Tube and Ceiling Plates complete, exclusive of Glass and Mantles, **£1 10s.**

5-Light Fitting, with Brass Flexible Tube and Ceiling Plates complete, exclusive of Glass and Mantles, **£2 10s.**

Other Clusters at proportional prices.

Finished Bright, Antique Brass, Antique Copper, and Oxidized Silver at usual Extra Charges.

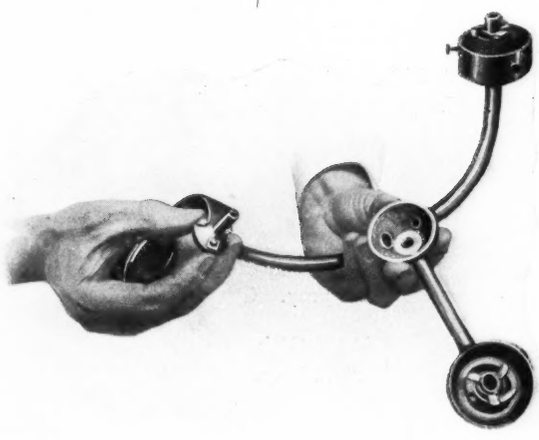


Fig. I.

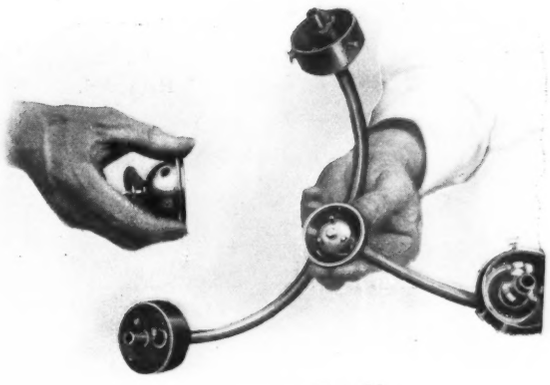


Fig. II.

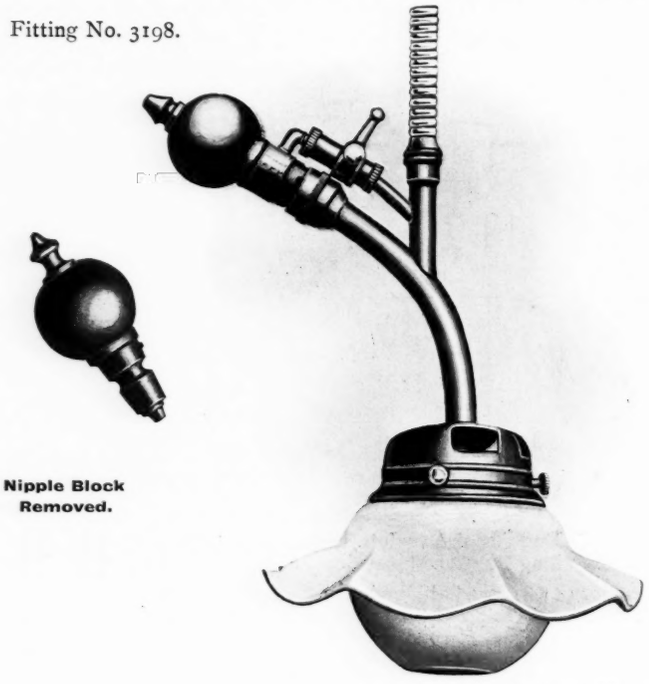
The above prints show how the Nipple Block may be removed, cleaned, or adjusted, and re-fitted in less than **Two Minutes.** Fig. I. shows the Nipple Block removed. Fig. II. shows the Nipple Block replaced with the lower half or Ball Air Cone about to be replaced also.

This method is applicable to all Fittings, except those with separate Cocks to each Burner.

PATENT ECLIPTIC FITTINGS.

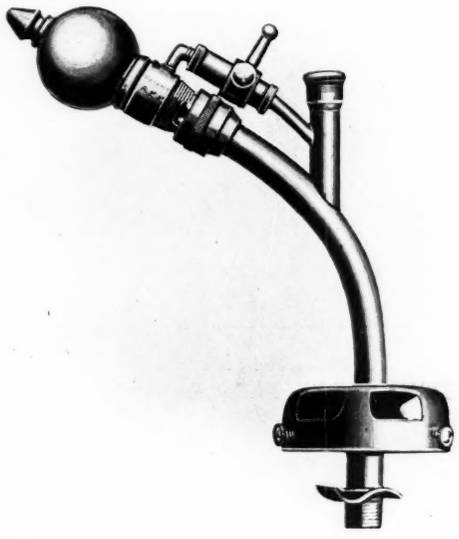
The "FLOSS," Patented. (Provisionally.)

Fitting No. 3198.



Nipple Block Removed.

Fitting No. 3198.



Registered No. 450,731.

PRICES:

Pendant Burner with Cock, Flexible Tube, and Ceiling Plate, exclusive of Glass and Mantle, **10s. 6d.**

Pendant Burner, exclusive of Cock, Flexible Tube, and Ceiling Plate, Glass and Mantle, **4s. 9d.**

The "WON" Brackets made with Arms A. B. C. D.

Patent applied for. *Registration applied for.*

Fitting No. 3197. A.

Fitting No. 3197. B.

All these Bracket Burners, exclusive of Glass and Mantle **4s. 9d.**

Fitting No. 3197. C. With Nipple Block Removed.

Fitting No. 3197. D.

MANTLES **72s.** per gross.

Fitting No. 3197. C. With Globe and Shade.

All these Fittings to be obtained with the usual Discounts to Gas Companies and the Trade, and Special Discounts for Quantities, of

THE MANAGER, Gas Fittings Dept.,
Factory: BOND END,
NUNEATON.

And of all the principal Wholesale Houses.

the tube is weighed; this giving the weight of the free carbon in the tar.

The oven used is of galvanized iron, and is 20 inches high, 16 inches wide, and 14 inches deep. It is substantially as shown in fig. 1, and is arranged so that eight samples may be worked at a time. For the volatilizing-tube, a 6-inch test-tube is cut in two, so that the top is about 4 inches in length. A piece of muslin is wired over the flare, and a layer of sand about ½ inch deep is introduced. The tube is then ready for the contents of the tar-filters. The drying-train consists of a heavy glass tube about ½ inch internal diameter and 12 inches long, and contains broken lime for about two-thirds of its length, and phosphorus pentoxide thoroughly incorporated in glass wool for the other third. This introduction of the glass wool with the phosphorus pentoxide prevents the gas from forming channels in the latter, and thus aids in rendering the extraction of moisture complete before reaching the naphthalene U-tube. The lime used must be extremely rapid in its reaction with water, in order to avoid too great expense for phosphorus pentoxide. We have found it necessary to make our own by igniting crushed limestone to a dull red heat for two hours in a muffle. If the lumps of lime are too small, the expansion attendant upon their slaking will crack the tube. If the lumps are too large, the gas will not be dried sufficiently. We have found that a satisfactory mixture is obtained by taking everything that will pass a 4-mesh and not a 12-mesh sieve. Connection with the naphthalene U-tube is made, as shown in fig. 2, through a glass sleeve made air-tight by a piece of gum rubber tubing placed over the hole. This prevents the naphthalene coming in contact with the rubber. It is well known that rubber absorbs naphthalene. Nevertheless we have found it safe to use rubber stoppers in the volatilizing-oven. Rubber stoppers in frequent use absorb all they can take up, and after a few runs cause no further trouble.

This method allows the estimation of water, anhydrous tar, free carbon, and naphthalene. The separation of the water and anhydrous tar is not very accurate; the light oils which are vaporized by the air drawn through being reported as water. The estimation of naphthalene is, however, quite accurate. The air passing through will leave the system saturated with naphthalene at the temperature of ice water; but this loss need not amount to more than a milligramme for each 10 hours' run. It is possible that naphthalene may be contaminated by other hydrocarbons, and, as was pointed out last year, the deposit is sometimes slightly oily and has a low melting-point. An attempt has been made to determine the nature of this oil; but its small amount makes it difficult. It has been shown that it is an unsaturated hydrocarbon; and it is very possible that it is the little-known indene (C_9H_8)—a transition product between benzol and naphthalene, which has been isolated from the tar distillates in which naphthalene occurs to the greatest extent. This oil has been found quite abundantly in our analyses of some tar distillates, as would be expected of indene. It is also present in some tars to a greater extent than others. In any case, however, it seems justifiable to report it as naphthalene, because it will be found associated with it, and will separate out with it on a large as well as a small scale. It is possible that the presence of this oily liquid may aid in preventing solid deposits of naphthalene; and its occurrence is worthy of note.

Appendix III.—*Method of Determining the Absorbent Power of Tars for Naphthalene at Various Temperatures.*

A 1-oz. wide-mouthed bottle, with a carefully-ground glass stopper, is fitted with a band of heavy copper wire around the neck, so that the stopper may be wired in, and a wire tripod is made to slip into the bottle. About 1 gramme of tar is weighed into this bottle, and a small glass thimble containing naphthalene, in amount not to exceed 25 per cent. of the weight of the tar, is placed on the tripod above the tar. The stopper of the bottle is lubricated with a stiff rubber vaseline lubricant, and the stopper wired down. The bottle is then placed in a constant-temperature oven, where the naphthalene vaporizes until it has reached its vapour tension corresponding to the temperature. No more naphthalene can now vaporize except to replace that absorbed by tar. On account of the viscous nature of the tar and the small amount of surface exposed, this absorption will be very slow, so that it requires two or three months for the tar to become saturated. The process is checked from time to time by taking the bottles from the oven, opening them at once, removing the thimble of naphthalene, and replacing the stopper before there has been any opportunity for the bottle to cool. After weighing the bottle, more naphthalene is put into the thimble if necessary and the bottle put back into the oven. The experiment is ended when the tar ceases to gain in weight; and the total gain will give the amount of naphthalene absorbed. At the higher temperature of 75° C. (167° Fahr.), a somewhat different arrangement has been found desirable, as subsequently explained.

The possible sources of error in this process are leaks, undue gas pressures, and vapour tension of the tar constituents. Leaks occur occasionally, and are detected by the failure of the bottle to attain constant weight, and by the disagreement of results on duplicate samples. The difficulty of tight joints becomes greater with the higher temperatures, because of the increasing fluidity of the lubricant and the greater gas pressures met with, as explained later on. On this account, in the 75° oven we have replaced the glass stoppered bottle by two test-tubes, each about 3 inches long and ¾ inch diameter; the tubes being selected so that one just fits inside the other. The inner one acts as the bottle, while the outer slips over it, and dips about ½ inch into a bath of mercury; being held vertical by guides, and kept immersed in the mercury by a lead cap. The mercury seal makes a tight joint, and acts as a safety-valve against possible unduly high internal gas pressures, which, however, are rarely encountered.

The second possible source of error in the process lies in the abnormal gas pressures. Solubilities of almost all substances are influenced by pressure; and if, on account of the vapour tension of benzol, water, and other substances of relatively low boiling-point, the internal pressure should rise much when the bottle was heated, the solubility of the naphthalene would be noticeably increased. A direct test of pressures at 45° C. (113° Fahr.) showed a maximum *plus* pressure of 2 inches of mercury—a negligible amount. Tests at 75° C. showed at first a *plus* pressure, which gave way later to a diminished pressure in the interior of the bottle, increasing for several days until it reached a maximum of about 6 inches of mercury. This was unexpected, and is almost certainly due to absorption of the oxygen of the air in the bottle by some of the unsaturated constituents of the tar. In order to avoid sucking mercury up from the bath into the tar samples on these 75° tests, and to avoid error from abnormal pressures, it is sufficient to raise the outer tube momentarily clear of the mercury seal, when air will be drawn in to relieve the partial vacuum. This should be repeated once a day for the first three or four days, after which no further trouble whatever need be apprehended.

An unavoidable source of error lies in the fact that the various substances in the tar possess vapour tensions, and dissolve to equilibrium in the naphthalene precisely as this dissolves in the tar. This is shown by the occasional oily condition of that which remains in the thimbles after they have been exposed for some weeks in the bottles. Fortunately, the vapour tension of the constituents of the tar is mostly much below that of naphthalene; and the error may be lessened by keeping the amount of naphthalene in the thimble at a minimum, as given in the directions. The error has, however been found serious at high temperatures, more especially with some tar distillates possessing high vapour tensions, and has necessitated a longer process to obtain reliable figures as to the amount of naphthalene they can absorb. Instances have occurred where the tar showed a loss of weight after the bottle had been sealed for several weeks. It had absorbed naphthalene to the amount of possibly 50 milligrammes; but it had given up more than this weight of its original substance to the naphthalene in the thimble, which had become an oily liquid. It is possible to obtain a correct result by analyzing this tar for naphthalene by the usual method of aspirating air through it. The error here lies in disregarding the quantity of tar which has volatilized into the naphthalene thimble. But as this volatilized lighter portion would have a somewhat higher absorbent capacity than the residual heavier portion, the absorbent power would be reported as too low. This is at least better than reporting too high; and the error would not be a serious one.

Appendix IV.—*Method for Estimating Phenols in Ammoniacal Liquor.*

For the analysis, a sample of a litre of ammoniacal liquor is filtered and then acidified, preferably with hydrochloric acid. A large quantity of sulphur separates; but the amount of phenols present is so small that they remain entirely in solution. The precipitated sulphur is carefully filtered out, and the perfectly clear yellow solution is placed in a bottle or jar. Chloroform to the amount of 100 c.c. is added, and the mixture gently shaken for an hour. The water solution becomes much lighter in colour, and the chloroform a dark brown. The two liquids are separated, and the chloroform distilled off, leaving the phenols, which, after drying, are in a condition to be weighed. This method is only an approximate one, as there will always be an equilibrium between the phenols dissolved in the water and in the chloroform. It would be possible to make it more exact by extracting with successive fresh portions of chloroform; but we have preferred to work a check analysis, starting with known amounts of phenols, and making the necessary correction. The phenols used had been separated from a sample of high-boiling tar distillate, and therefore were similar to those usually met with in tar. For the check experiment, weighed amounts of these phenols were dissolved in a litre of ammonium sulphide of 1·01 sp. gr. The following are the results:—

Experiment No.	Weight of Phenols Dissolved. Grammes.	Weight of Phenols Recovered. Grammes.	Percentage Recovered.
1	2·285	0·587	25·2
2	4·566	1·211	26·3
3	3·198	0·789	24·8

The percentages recovered are small, but they are very concordant, and independent of the weight of phenol within the limits met with in practice. This, however, is to be expected, as almost the only source of error lies in the incomplete removal of the phenols by the chloroform; and the relative amount of phenols dissolving in the water and chloroform will be dependent only upon the relative quantities of the two solvents. So long as the amounts of chloroform and ammoniacal liquor are unchanged, the percentage recovery should be a constant. The method is believed to be fairly accurate, provided each analyst makes his

own check analysis, and determines for himself the necessary corrections.

Discussion.

The PRESIDENT (Mr. E. F. Lloyd) having invited discussion on the paper,

Mr. V. F. DEWEY (Detroit) remarked that in the course of the paper the authors stated that in Detroit the proportion of naphthalene dissolved in tar was 94½ per cent., while in Ann Arbor it was 95 per cent. There was a difference of less than 1 per cent.; but this quantity of naphthalene left in had a considerable effect when the gas reached the mains. He also noted that the free carbon in the tar at Detroit was 39·3 per cent.; while in Ann Arbor it was 33·2 per cent. The point he wished to make was this: Why was it that, under practically the same conditions, the proportion of naphthalene dissolved in tar in Detroit was less than in Ann Arbor? It might be that it was because of the greater quantity of free carbon or of water in the tar. Another point he had thought of was in connection with the effect of the ammoniacal liquor upon the saturation of phenols, and the setting free ultimately of the naphthalene in the tar. He knew it was the practice in Detroit to return the liquor from the main to the main—in other words, it was a continuous system. This was induced by means of jets; and he wondered if the liquor would have a tendency at this point to do what was stated in the paper. He had spoken to Professor White about it, and he did not think it would, inasmuch as the liquor at this point would contain ammonia salts, which, being acids, would not react on the phenols. Another question he would like to ask was this: Was the overflow from the hydraulic main being introduced into the washer scrubber or the rotary scrubber? He had done this for a little while down there, and did not know of any bad results; and he wondered what effect introducing the ammoniacal liquor which was in excess of the quantity put into the hydraulic main would have upon the liberation of the naphthalene when introduced into the rotary scrubber. Another point which was not made clear in the paper, especially in the table giving the percentages of naphthalene taken out by the Pelouze and Audouin tar-separator [Table IV., *ante*, p. 390], was the difference of pressure on the separator at this point. What would be the difference of pressure on it, and what effect would this have upon the absorption of the naphthalene? This point would probably be taken up in next year's work. To him the paper was the most interesting one that had been read before the Association; and in the light of the work done, he thought it would be interesting to branch off at some future period and deal with the cause and the effect—or rather the cause—of the formation of naphthalene. As stated in the paper, it was not the province of the authors to determine this. There were very interesting conclusions which might be drawn from the paper that would lead one to believe that there was something in the peculiar method of distillation that would account for the formation of naphthalene under different conditions.

Mr. B. O. TIPPEY (Detroit) said that in the new plant at Station A, in Detroit, there was a time when considerable trouble was experienced with naphthalene, previous to that at which the tests were made. The charging-machine did not then convey the coal to the back end of the retort, and they undoubtedly produced a very great deal more naphthalene than while the tests were in progress. They also made a heavier tar, and considerably more lampblack; so that while they were making more naphthalene, they made a tar that would not be capable of dissolving so much of it as tar made while the tests were in progress. They had naphthalene stoppages in the condensers, washers, and scrubbers. While this unsatisfactory condition existed, so far as the tar-extractor was concerned, they bye-passed it, and let it go forward through the condenser. The stoppages ceased, and there was no more trouble. It had been their practice ever since to allow a little tar to go past the separator. He noticed that in some of the tests there was more tar in the gas at the inlet to the secondary condenser than at the outlet; showing that the gas lost naphthalene in passing through the condenser. He also observed that the tar at the outlet of the condenser contained more naphthalene, which indicated that the gas lost it and the tar had picked it up. He was inclined to think that if they had more perfect contact of the hot tar and the hot gas before the separator was reached, so that it could thoroughly absorb the naphthalene—if they were to remove the tar entirely at the inlet to the condenser—they would not have any naphthalene at all; and that as there would be no tar to reach the scrubber, it could not give up naphthalene at this point. But as in their plant they could not get sufficient thorough contact to take out all the naphthalene before the separator was reached, the tar was allowed to go through. The temperature at the inlet of the secondary condenser was 110° down to about 90° Fahr. At this temperature the tar had a great affinity for absorbing naphthalene; so that they had practically double the contact of the tar and the hot gas by allowing the tar to cool in the secondary condenser.

The SECRETARY (Mr. H. W. Douglas): Under these conditions, would it not be wise to put the Pelouze and Audouin separator after the secondary condenser?

Mr. TIPPEY: I do not know why you could not. The only reason why it should not be placed there would be that if the gas and tar are brought to any extent in contact below the temperature of 95° to 100°, the illuminating value of the gas is deteriorated. We tried that repeatedly at our plant—lowering the temperature in the primary condenser, before the separator is reached, below 95°; and in every case the candle power of the gas dropped. We found about 95° was the dividing-line. To be safe, we ran to above 100°, and it took most of the tar—the heavy tar—out of the separator.

Mr. W. H. BARTHOLD remarked that, by placing the separator after the secondary condenser, there would be so little tar that he did not think the present form of the apparatus would take out the last trace. The authors of the paper suggested that the engineers should make the foul mains larger, so as to allow of contact of the tar vapour in the gas after it left the hydraulic main. This could perhaps be accomplished by putting in a large scrubber shell without any trays in it. He had charge of the old works in Milwaukee, which had a large shell into which the gas passed on leaving the hydraulic main; and they claimed that it did a great deal to keep down the naphthalene in the works. He was not prepared to discuss the paper, as it required considerable time to digest thoroughly; but he wished to say that it was attacking the naphthalene question in the right manner. From year to year the different Associations had discussed this subject, and the discussions had been more or less repetitions—did not bring forth anything new; and therefore he was glad that the Michigan Association were taking up the work, which ought to place it right in the front.

Mr. H. RUSSELL said that, like Mr. Dewey, he had for the last few years been out of touch with naphthalene troubles; but the fact that the higher the temperature of tar the more naphthalene it absorbed, seemed to him almost revolutionary in character. He had always maintained that the way to stop naphthalene troubles was to have a primary condenser—an air condenser. He had a specially good opportunity to notice this at Cincinnati, where there was no tar-separator whatever, but instead a long series of pipes acting as a primary condenser; and during all his experience there they had absolutely no trouble with naphthalene, though he must say that tars went past to the purifier. Evidently the contact of hot gas with hot tar was doing something for naphthalene in those works. He did not see why Detroit should have more tar, where they had more free carbon than at Ann Arbor. At Detroit, they had lower temperatures, and he should think it would be just the opposite condition in regard to tar. He thought the work of investigation should be continued for another year. This was the first paper which had pointed out anything definite to gas men. Possibly in another year the authors would be able to tell the members just how to get the naphthalene out of the gas, and indicate exactly where they should get it out—in other words, tell them just how to handle it, and what sort of apparatus to use. After this had been determined, it seemed to him that the investigators ought to tell them how not to make naphthalene at all, or, at all events, not to make it in any more than a reasonable quantity. One problem was to get rid of it after they had made it; but another was how not to make it at all.

Mr. A. F. TRAVER said his experience at Grand Rapids had been similar to Mr. Tippey's. They had had a great deal of trouble with naphthalene in the scrubbers; but since they got rid of this by bye-passing the tar-separator, and allowing some of the tars to go through, they had not been troubled at all. The paper was very interesting to him at the present time, because they had just changed their condensing system entirely. They were pumping the gas hot, and it was being kept in contact with the tar much longer at this high temperature than was now done in any other works in the State. The result would probably be that Mr. Barnes, who held the fellowship for next year, would get some results which he could not obtain anywhere else. The contribution under discussion was, he thought, the most interesting naphthalene paper that had ever been written, and it would take a lot of study. There was one point that impressed him, and that was the amount of naphthalene formed at different hours. He always thought that more would be formed during the later hours than during the first, where the gas-flow was very swift; but, according to the experiments described in the paper, this was not the case. He did not know exactly how to explain it; and he should like to ask Professor White if he could tell the members why this should be so.

Professor CAMPBELL expressed his gratification at the way in which the paper had been received, and said he should like to take the opportunity of remarking that it seemed to indorse the position on which the Association had been sustaining the fellowship in response to the request he made at the time the University induced them to support it. The function of the University was to develop new truths, new facts—simply to bring out facts themselves, irrespective of their bearing; and the paper before them had certainly brought out a number of extremely interesting facts. As Mr. Traver, and especially Mr. Russell, had said, they might teach them not only how to remove naphthalene, but also how to prevent its formation. Perhaps he might say he did not feel that it was their place to show the mechanical side of the method of removing naphthalene. The object of this research work was to bring out knowledge—definite facts as to why and when naphthalene was removed. Mr. White proved that with a rise of temperature there was an increased solvent action of the tar; and he had brought out some facts. He (Professor Campbell) had no doubt at all as to there being ingenuity enough

among the members of the Association to apply this knowledge practically for the benefit of the gas industry. It was not the object of the University to apply this knowledge; their endeavour was to educe new knowledge. The broader problem which Mr. Russell had suggested—as to the cause of naphthalene—brought out, as was stated in the paper, the whole question of distillation. To his mind, one who looked a little ahead could conceive what an enormous field there was there for research. It had been scarcely touched at all; and he thought it was one of the most promising fields for subsequent research. In the paper before them, there was shown a variation in the solvent action of tar, as influenced by temperature. Then came the point arising out of this—that there was a variation in the solvent action of different tars at the same temperature. This would at once lead to the question in connection with the destructive distillation of coal: What is the relation between time and temperature, and different coals, and combinations of coals, and tars? If one stopped to think over this, he would see at once that there was work enough in it for years to come in research work for the production of new facts and new knowledge. He thought there would be no question as to gas men being able to appreciate new facts, and apply them to the advancement and improvement of the gas industry. He appreciated very much the support the fellowship had received; and he trusted the members would feel that the money they had devoted to it had been really well invested.

The PRESIDENT said he thought he could assure Professor Campbell, on behalf of the Association, that they had a most high appreciation of the extremely valuable, and he might say unselfish, work which the University were doing, and of the hearty manner in which they had carried on the work, which absolutely could not have been done by any individual member of the Association. He did not think it could have been done by any company singly, by reason of the length of time and the large facilities required; and also the collateral facilities, if he might use the term, which the University had for this work. It was certainly gratifying to the Association.

Mr. DEWEY said he should like to ask a question on a matter to which Professor Campbell had referred—viz., the solvent action of different kinds of tar. He asked it because of the experience at Grand Rapids in dividing it, and allowing a portion of the lighter tars to pass the separator. What was the absorbing power of the very light tar that was allowed to go through? He had been unable to find out. He thought the reason for Detroit and Grand Rapids having had different results from what would have been expected was probably explained by the fact that this tar undoubtedly had a very high absorbing power, and the naphthalene must have been absorbed by the light tar.

Mr. RUSSELL: It occurs to me that the difficulty at both Grand Rapids and Detroit is rather more subject to the time element than to anything else. When they are operating the tar-separator differentially, they increase their absorbing surface, and the gas passes too fast. All through the paper, it has been shown that time plays a very important part. I suggest that this might be true in the case of the tar-separator—that the gas flows at too great a speed. In other words, if one had a larger separator, it might remove the difficulty.

Mr. BALL said he noticed that the tar at a temperature of 106° Fahr. absorbed nearly 50 per cent. of naphthalene. The tar in the hydraulic main was perhaps not quite at this temperature, but it was almost. It seemed to him that in their experiments last year they found that it did not hold more than 5 to 6 per cent.; and he wondered what became of the naphthalene—whether it was redistilled or volatilized in some way.

The PRESIDENT asked Professor White to close the discussion.

Professor WHITE said: A number of gentlemen have dwelt on much the same points, so I shall not attempt to take up the questions as they were asked one by one, but rather the different subjects. The first one was by Mr. Dewey, in regard to the fixed ammonia taking phenols out of the gas. I do not think that fixed ammonia would have the same effect as volatile ammonia. In the hydraulic main, the ammonia is largely firmly fixed as salts; but in the scrubber, where the volatile ammonia is largely in excess, I think the ammonia will continue to act in removing phenols, unless some steps are taken to actually acidify the liquor in the scrubbers, which would be something of doubtful practicability—at least, it requires a different structure of scrubber. In regard to the differential pressures of the Pelouze and Audouin tar-separator, we have no complete records of them in any of our works tests, for they did not have pressure-gauges by which we could make tests. Of course, the greater the differential pressure, the greater is the rate of gas passing through perforations in the screen of the tar-separator; and there can be such a thing, I imagine, as the gas passing through so fast that the tar would not be deposited. I can understand that gas passing through very fast, at a high differential pressure, might not deposit tar like gas which was passing through more slowly. It is complicated, however, as almost all these questions are, by a number of different factors. One of them, I am quite certain, is the temperature of the gas entering the separator. The important point about that is the difference in the viscosity of the tar at the different temperatures. If the temperature of the Pelouze and Audouin apparatus is low, more tar has been separated in the primary condensers—there is not so much going to the separator—and the tar is quite stiff, and as it goes through the perforations and strikes the baffle-plate, it has a tendency to stick and be removed from the gas. If the temperature at the outlet of the primary condenser is high, more tar will pass to the separator. That tar will be fluid, and the tendency will be, on striking the baffle-plate, to splash back, especially if it is going at a high velocity. Under such circumstances, I can quite see that more tar will pass through. The question as to the effect of the denser tars and lighter tars as they go forward, is one that will have to be settled by more work. We have one or two tests in hand on this point; but it takes three months to determine the amount of naphthalene which tar can take up at a given temperature. In another year from now we shall have some further evidence on the subject. The practice at Detroit and Grand Rapids, of letting some tars purposely pass the separator, is extremely interesting. Some tests have already been made which were not reported on at Detroit. With Mr. Tippey's co-operation, we expect to keep on until we find exactly what is the effect of letting some of the tars go forward. When we get to the question of the formation of naphthalene, we are very much in the dark; and I think I cannot answer any of the questions which have been put in regard to this matter. We know that apparently trivial things influence very much the extent of its formation. At the University this year, Mr. Barnes tried for six months to distil one sample of coal in the small laboratory apparatus, where we had our conditions as nearly uniform as we could get them; and he endeavoured to determine the influence of temperature on the quantity of naphthalene formed in the apparatus. But in almost every case there was evidently some variable which was more important than the variable of temperature. So we came to the conclusion, after some eight or ten distillations, that it was practically the method of charging the little retort which was causing most of our difficulty. The method of charging was more important than the temperature. We made some experiments at the works; but we think the data are not sufficient to allow anyone to explain them, and so they are put away until we get enough information to enable us to do so. We know the method of charging exerts some influence, and so must the temperature; but we do not know why it is Detroit has a higher percentage of free carbon than Ann Arbor. Professor Campbell, I think, has outlined very well our plan in attacking this problem. We hope to acquire considerable further information during the coming year. If the question is to be solved under the best conditions, it can only be done when we can regulate or eliminate as many of the absolute variables as is possible. We ought to be able to work with only one condition at a time; and we shall never be able to do this in the gas-works, because there are certainly ten, or possibly a hundred, differences which hinder us. The ideal way would be to isolate a single full-sized retort provided with its own condensing system. Under these circumstances, we should probably be able to regulate our conditions fairly well, and obtain results much more quickly than we otherwise could do; and I am quite confident that these results could then be applied to the full-sized plant.

The PRESIDENT asked Professor White what percentage of tar he had found in the gas—the percentage of the total tar produced—at the inlet to the scrubbing system in his experiments. Was it given?

Professor WHITE said it was not given in so many words; but only 1 to 3 per cent. of the total tar produced ever got as far as the scrubbers.

The PRESIDENT said the reason he asked was because it seemed to be very difficult to eliminate all the tars—tar vapours after the use of water or ammoniacal liquors—in some manner. It was evident, from what had been done this year, that to eliminate any tars with ammoniacal liquor was something to be looked upon as a distinct question. If they could get out all the tars by mechanical means, it would seem that they would be nearly at the end of their trouble. He had had a discussion with Professor White a few days previously with respect to some proposed apparatus for the University, by which they could conduct this work in a little more systematic manner. It was suggested last year that experimental plant should be put up at the University, making it possibly to a quarter scale—that they should provide complete plant from the retort to the holder. The University acted on this matter, and were far-sighted enough to say that they would find accommodation for anything the Association might supply; and the plant was in such shape that it could be put in at any time. This suggestion, however, did not seem to altogether meet the conditions that they were striving for. If the retort was one-quarter size, the gas produced in the rear end of it would have only half the travel of gas in a retort such as they were using. They employed a 9-foot retort, because this was about as far as a man could throw coal. There were practical limits to the size of the apparatus; and to produce the gas in a retort which would not be the same as one used in practice would be working under artificial conditions. It seemed that the present work for them—possibly looking at the matter from a commercial standpoint—would be to let the University endeavour to prevent some of the troubles they had been having when they were producing gas under ordinary circumstances. It was now proposed, as Professor Campbell suggested, to isolate three retorts in the Ann Arbor works. Mr. Douglas had kindly consented that this should be done under certain conditions which were exceedingly favourable to the Association. They were now endeavouring to devise apparatus to deal with a small quantity of gas, and give it precisely the same treatment, actual and theoretical, that it would receive in works where a large quantity was made. It might seem

strange to some, but it would be a simpler process to deal with a million than with 5000 cubic feet of gas. However, the Association hoped to have something accomplished before another year had expired. He thought, without further action on the part of the Association, a vote of thanks to the Faculty would be entered upon the record, for the work they had done in this matter.

STRUCTURAL STEELWORK FOR GAS-WORKS.

By W. S. Smart, of Saltley.

[A Paper read before the Midland Junior Gas Engineering Association, Nov. 4.]

When alterations, extensions, or additions are required, the engineer who has charge of the works, is in most cases expected to design them, without calling in the aid of a consulting engineer. To do this efficiently, he will require a thorough knowledge of structural iron and steel work and its design, owing to its entering so largely into modern gas-works construction. In erecting new works with a capacity of 10 million cubic feet of coal gas per day on similar lines to the plant which the members inspected on their recent visit to the Nechells works, approximately 50 per cent. of the total expenditure incurred (exclusive of the cost of land) would necessitate a knowledge of structural iron and steel work when designing.

There is often a very great difference in weight between designs of various engineers for practically similar structures. Two roof-principals between 70 and 80 feet span, illustrated in the technical journals some time ago, may be taken as an example of this. No. 1 principal weighed 52 lbs. per foot of span, while No. 2 principal weighed 78 lbs. per foot—being a difference of 50 per cent. The rafter of No. 2 principal was 90 per cent. heavier than the rafter of No. 1; but, on the other hand, the main centre tie of No. 1 principal was 34 per cent. heavier than the centre tie of No. 2.

Structural design chiefly consists in calculating the loads carried by the structure, ascertaining the amount and character of the stresses produced, and proportioning the materials to resist these stresses as near as practical considerations will allow. The loads and stresses on the two roof-principals would be practically identical; so it is difficult to account for the differences in weights shown—especially in the ties and rafters referred to.

There are about fifty or sixty standard works on the subject of structural design; but there still remain many points upon which we possess little or no reliable information; and therefore formulæ recommended by different authorities vary considerably, and it is often puzzling to decide which to adopt.

To deal in this paper with the more complicated structures, such as gasholders, large-span arched-roofs, &c., would take up more time than we have at our disposal; so that I shall have to confine my remarks to the simpler structures. I hope, however, that other members will deal with them on some future occasion.

In the appendix to this paper [pp. 472-3], will be found drawn out a design for a two-storey steel purifier-house, the purifiers to be placed on the ground floor, and the upper floor used for oxide-revivifying or lime-slaking. I have endeavoured to show as clearly as possible the formulæ and methods recommended by the writer for use in designing such a structure as this.

For the sake of clearness, the floor itself has not been shown; but the most suitable construction for it would be concrete arches, either centred on corrugated iron curved sheets or reinforced with expanded metal. The girders supporting the floor have been designed for a load of 3 cwt. per square foot of floor area, including the weight of the concrete, which, by adopting the reinforced system, would weigh some 56 lbs. per square foot of area covered, and thus leave about 2½ cwt. per square foot for a working load. This would admit of the floor being covered with slaked lime, to a depth of 5 feet all over—a very unlikely condition for the whole area, but one or two bays may be so covered, so that all must be calculated accordingly.

One of the first points to be settled is the material to be adopted, and to specify its strength. Wrought iron (except for forgings and other special purposes) has practically been superseded by steel for constructional work. The great superiority of steel is that it is from 40 to 50 per cent. stronger than wrought iron, while another of its advantages is that it can be rolled in much longer lengths and heavier sections; the limiting weight of a wrought-iron plate being about ½ ton, and in steel about 6 tons.

Steel is often stated to require greater care to prevent excessive rusting and corrosion—especially in positions where it is occasionally submerged in water. For this reason, the sides of gasholders and purifier-covers are at times specified to be in iron.

The steel generally used for constructional work is of a mild description; and it is usually specified to have an ultimate tensile strength of not less than 28 tons, and not exceeding 32 tons per square inch of section, with an elongation of at least 20 per cent. on 8 inches. One test piece may be taken from each cast or blow, which, if upon testing does not conform to the specification, the remainder of the material from that particular charge may be rejected.

Some engineers specify the chemical composition of the steel; but for structural purposes the writer does not think this is necessary. The steel is produced by either the Bessemer or Siemens process or modifications of them. Bessemer steel is reputed to be less reliable than that produced by the other process, and consequently requires greater care in testing.

The class or grade of the work required should be distinctly specified; and all ambiguous terms such as "the best and most workmanlike manner" should be avoided.

In order to keep the cost of the work as low as possible, the following specification may be adopted: All holes punched, except where the diameter of the hole is equal to, or less than, the thickness of the metal, when the hole must be drilled out solid. The edges of all plates, bars, angles, &c., to be sheared or cold sawn to exact lengths, and where possible rough edges to be taken off by an emery wheel. Principals to be sent from the works in pieces, and bolted together on site. Purlins to be bolted to rafters and girders to columns, &c.

Most of the work when designed by contractors in competition, is carried out in this manner: Engineers, generally, want a higher grade of workmanship and construction, and require: (1) All holes to be punched $\frac{3}{16}$-inch less in diameter, and then drilled out to the full size, when the work is assembled together for rivetting, or alternatively. (2) All holes to be drilled out from the solid, punched work not being allowed. (3) Edges of all plates bars, &c., to be machined. (4) Principals to be riveted together, as far as possible. (5) The structure to be riveted up complete at site. (6) All work to be erected as far as possible, for inspection in contractor's yard.

It may be interesting to give approximately the extra cost this involves, per ton, for the labour only:

Item 1	. .	£0	7	6	per ton on girders.			
„ 2	. .	1	0	0	„	„	„	„
„ 3	. .	0	10	6	„	„	„	„
„ 4	. .	0	7	6	„	„	„	principals.
„ 5	. .	0	10	0	„	„	„	„ and girders.
„ 6	. .	1	7	6	„	„	„	all work.

The structures designed by contractors, and made in the manner before indicated, fulfil all the conditions for which they are erected; and when this is so, the writer questions the wisdom of spending additional money in obtaining a higher grade of workmanship, &c.

The cost of structural work varies with the cost of the raw materials; and as these fluctuate widely, it is often difficult to estimate with any degree of accuracy. The method recommended by the writer, is to obtain from the trade journals the current prices of the joists, channels, &c., of which the work is composed—for example, say £6 0 0

Allow for waste, &c., 7½ per cent., say . . .	0	9 0
Labour (purlins, say 15s., riveted columns, 25s.), roof principals, £2 (flat ties), lattice girders, £2 10s., plate girders, £2 5s.—say, for plate girder	2	5 0
Allow for establishment charges 40 per cent. on the cost of labour—40 per cent. of £2 5s. .	0	18 0
Delivery, say	0	2 6
Erection, say	1	0 0
Incidents on erection, 10 per cent. . .	0	2 0
	£10	16 6
Profit varies from 7½ to 12½ per cent. according to state of trade—say 10 per cent.	1	1 8
Price per ton of plate girder	£11	18 2

Add to the cost of labour given that from items 1 to 6 if the work is to be carried out as there specified.

Only British standard sections shown in the Engineering Standards Committee Handbook should be adopted and shown on the drawing. This is the handbook referred to in the appendix; and giving the properties of the sections, such as centre of gravity, moments of inertia, radius of gyration, &c., saves a vast amount of time in calculations when designing structural steelwork. Even by taking the precaution of using only standard sections, one must not be surprised to receive applications from the contractors, to be allowed to substitute alternative sections.

With wrought iron, it is comparatively easy to obtain any section specified; there being a large number of firms engaged in its manufacture. When not very busy, they can generally be persuaded to mount the rolls specially for anything over a 5-ton lot. The number of steel-works being rather limited, before mounting the rolls they require orders for at least 300 to 400 tons of a particular section; so it often happens tha tno definite promise of delivery can be given for sections, if the rolls for these have only lately been in.

Many people still persist in adding the word iron after angles, tees, &c.; and it is puzzling to see (say) a section figured on the drawing as 3-inch by 3-inch angle iron, when the specification distinctly states the material to be of mild steel.

Fully detailed drawings should be supplied to the contractors; but where, for some reason or other, this is not possible, the contractor should be required to supply these for approval before putting the work in hand. When work is carried out to drawings with very few details, it is often left for the contractors' template maker to supply them himself, by a process of guess work.

In America, the drawings are more thoroughly detailed out than

is usual in this country; and, in addition, the character and amount of the stresses are shown on the drawings. This enables the workmen to pay particular attention to the members of the structure receiving the greatest amount of stress and also not to waste time in machining and fitting, where the stresses do not require this—as, for instance, at the ends of tension joints. The specification should only describe the extent of the work, &c.; all other information—such as the size of the various sections—should be figured in the drawings.

Some engineers supply bills of quantities when inviting tenders for structural steelwork. This generally does not involve very much extra trouble, as the weights are usually taken out beforehand, in order to estimate the probable cost. In order to obviate any chance of the correctness of the quantities being questioned during the progress of the work, one of the leading railway companies issues bills of quantities with the intimation that they are for purposes of tendering only. The successful contractor is allowed one week in which to check them, before signing the contract; but after this has been signed, the amount of the tender is considered as a lump sum price for the job complete, and no question as to the accuracy of the quantities can be raised.

The Appendix shows some common types of girders, columns, roofs, &c., used on gas-works; and we will now proceed to consider them.

Taking girders, they are generally divided into (A) solid rolled sections; (B) compound; (C) plate; (D) braced. The principal solid rolled sections are angles, tees, channels, joists, &c. The first two sections can, of course, only be used for comparatively short spans and light loads. Angles are used as slate laths to the roof of the purifier-house; so these will be dealt with when considering the roofing. Channels—owing to the restricted width of the flange—do not make an economical form of girder by themselves. The largest standard channel is a 15 inch by 4 inch by 42 lbs. per foot run. Rolled steel joists may now be obtained in thirty different standard sizes; the heaviest being a 24 inch by $7\frac{1}{2}$ inch, weighing 100 lbs. per foot run. Where the span and load will allow, they are displacing to a great extent riveted-up plate-girders—not on account of any economy in weight, as the use of solid rolled sections always involves a certain amount of waste towards the ends of the girders, owing to the impossibility of proportioning the metal in the girders to meet the decreasing bending moments, which, as will be seen later, is generally possible in heavy plate-girders. They have the advantage, however, of being readily obtained—many merchants stocking large quantities—and they are, of course, much cheaper. Many structural steelwork makers try to arrange to have all holes which may be necessary in these done at the rolling mills, and sent to the job direct; any other work required being done on the site. Holes drilled in the flanges cost about 3d. each; and punched in the web, about 1d. each. Where there are but few holes, they are paid for by the saving in carriage to the bridge yard alone, without taking into account the establishment charges, labour, &c. This should be kept in mind, because it is often possible to dispense with joggling and notching and other work which would perhaps render it necessary for the joists to come to the bridge yard.

In the Appendix the method of calculating out the bending moments, and obtaining the size of the joist necessary, is shown, and is a very simple matter, easily understood, and calls for no further comment. The joist adopted for the purifier-house shown is a 20 inch by $7\frac{1}{2}$ inch, weighing 89 lbs. per foot; and the calculated stress on it will be $7\frac{1}{2}$ tons per square inch.

In using both kinds of girders the following points should be observed: For ordinary loads, and work of a permanent character, a stress of $7\frac{1}{2}$ tons per square inch should be adopted, but under no conditions should the stress exceed 9 tons per square inch. Although, probably, the breaking strength of the joist, &c., would be about 30 tons per square inch, it should not be forgotten that a permanent set would take place with 17 or 18 tons stress. With girders carrying rapidly-moving loads, or subjected to vibration, the stresses should be kept down to between 4 and 6 tons per square inch, depending upon the ratio of the fixed to the live or moving load. Holes in the tension flange of the girder must be deducted from the size of the flange when they occur near the point of maximum bending moment. When, however, they occur towards the ends, or in the compression flange, with rivets properly filling the holes, they may be overlooked. If no lateral support is afforded to the girder, and the span exceeds twenty times the flange width, to prevent side yielding the allowable stresses on the beam should be reduced as follows:—

30	times	flange	width	9-10	of limiting	stress	under	ordinary	conditions.
40	,,	,,	,,	8-10	,,	,,	,,	,,	,,
50	,,	,,	,,	7-10	,,	,,	,,	,,	,,
60	,,	,,	,,	6-10	,,	,,	,,	,,	,,
70	,,	,,	,,	5-10	,,	,,	,,	,,	,,

Girders of short spans, and carrying heavy loads—and especially when carrying concentrated loads near the ends—are liable to fail by shearing.

It is considered good practice to limit the deflection to one-thirtieth of an inch per foot of span, or the total deflection not to exceed 1-360th of the span. Approximately twice the depth of the beam in inches gives the span in feet of a beam having a deflection of 1-360th when stressed to $7\frac{1}{2}$ tons per square inch. The shear and deflection lines are generally shown on the tables of strengths in makers' handbooks; and from an inspection of these, it will easily be seen if it is necessary to make any allowance for shearing and deflection.

Plate girders can be used with economy for all spans between (say) 25 and 100 feet. The most economical depth is between one-tenth and one-twelfth the span. This type of girder has been adopted for the cross girder B; and the drawing of this, together with the necessary calculation, are shown in the Appendix.

There is still a great deal of variation in proportioning the flanges of plate girders. Some engineers do not take into account the angles connecting the flange-plate to the web-plate; others take the top portion only. In the calculations for girder B in the Appendix, all the angle is taken into account; and the writer cannot see any good reason why this should not be done, as a quarter of the web-plate is often assumed as constituting part of the flange, and reckoned accordingly. All the flange plates need not extend the full length of the girder; and the method of obtaining the position where they may be stopped, is shown graphically in the Appendix.

It is good practice to allow one flange-plate on each flange to extend for the full length, as by doing so the girder is stiffened considerably. The web-plate takes up the shearing stresses, which for steel webs should not exceed 5 tons per square inch. The shearing stress at the ends is equal (with a distributed load or concentrated load in the centre) to half the load. The shearing stress alone does not fix the thickness of the web, as it must be prevented from crippling or buckling; and also the provision of sufficient bearing area for the rivets joining the flange angles to the web-plate must be considered.

The shear stress is assumed to be transferred into the flange angles in a length equal to the depth of the girder; and sufficient rivets must be provided in this length to meet the stress. Thus girder B at the ends requires sufficient rivets in a length of 48 inches to withstand a stress of 75 tons. Although in double shear—that is, when before failure, the rivets must be sheared at two sections, as in this case—a $\frac{7}{8}$-inch diameter rivet would stand $1\frac{3}{4} \times 3$ tons single shear $= 5\frac{1}{4}$ tons, yet as the bearing value of a $\frac{7}{8}$-inch diameter rivet on a $\frac{9}{16}$-inch plate $= 4{\cdot}9$ tons, this, the lowest value, must be taken. Calculations show that 3 inches at the ends and 4 inches towards the centre of the girder should be adopted for the pitch of the rivets; but some standard pitch—such as 3-inch, $3\frac{1}{2}$-inch, 4-inch, or 5-inch should be adopted in preference to pitches such as $3\frac{3}{32}$-inch, &c.

The rivets joining the angles to the flange-plates are governed by the pitch of the web rivets; and in most cases they need not be calculated. They may, however, be insufficient in the case of girders of short span carrying very heavy loads. Where there are several flange-plates, the area of the rivets between the end of each flange plate should not be less than the area of the plate to be next stopped.

Just what provision is necessary to guard against the web-plate crippling is a doubtful point. The writer uses the formula given in the Appendix with a considerable amount of latitude, and as an indication that they need not be closer than the distance obtained by its use, than as fixing the exact centres.

An article which appeared in the "Engineer" of Sept. 9 last year, and the correspondence and author's reply to same, may be consulted by those interested, with advantage. The formula recommended in the article gives stiffeners much closer than the one here used. They should, however, be placed under all concentrated loads, and at the ends of the girders. Tees need only be used as joint covers to the web, as light angles only are generally all that is needed for these stiffeners.

Braced girders, for short spans up to (say) 50 or 60 feet, are only used when the loads are comparatively light. Above that span, they are often used in America for heavy loads; but in England the practice is to keep to plate girders up to about 100 feet, above which limit braced girders are often adopted. The principal types are the Bollman truss, Linville or Warren girders, lattice and trellis girders.

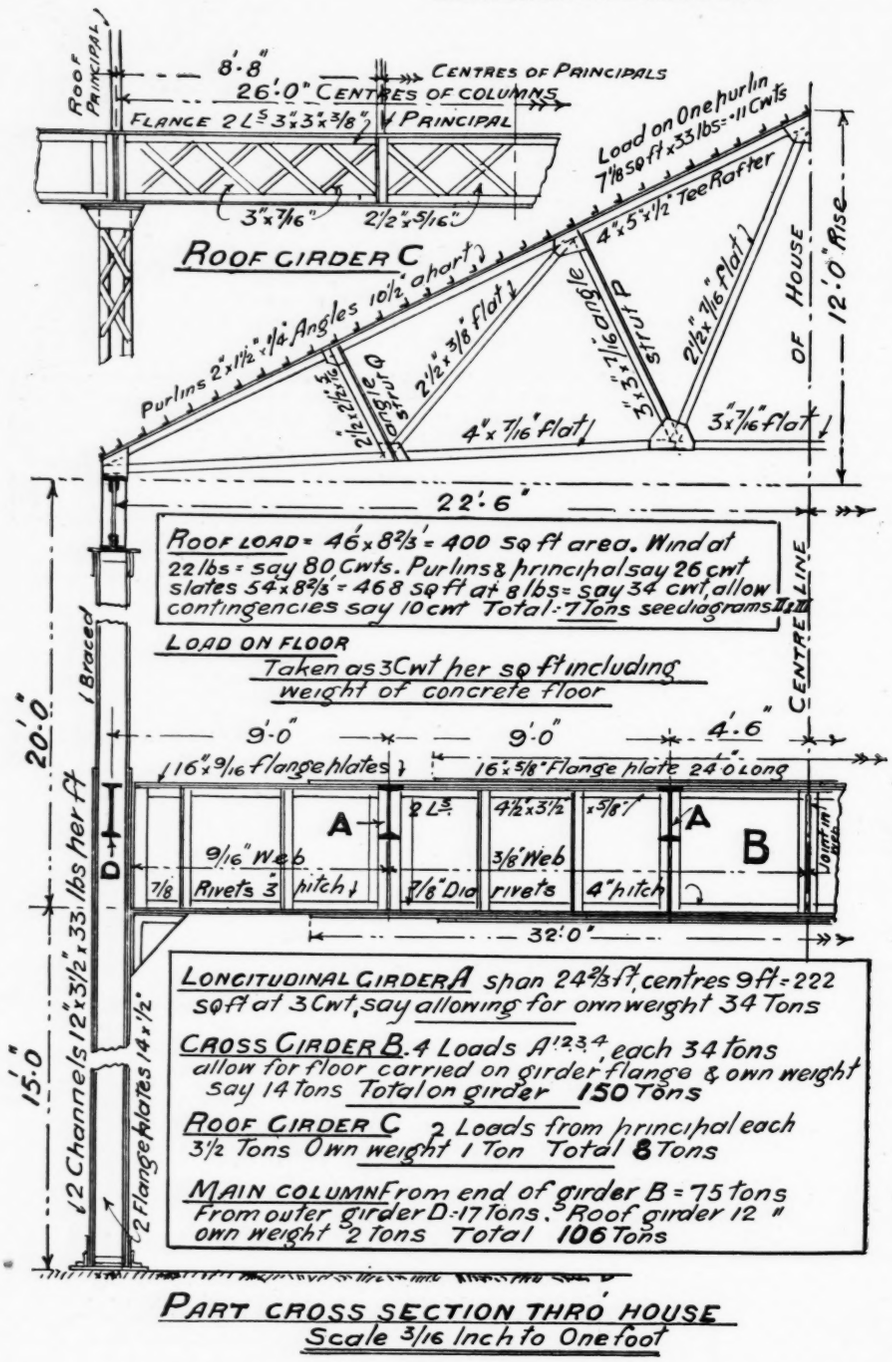
The Bollman truss is an economical style of girder for carrying a concentrated central load; but its use is generally restricted to spans of from 20 to 50 feet. Linville and Warren are common types of braced girders. Theoretically the Linville girder is the most economical, as the struts being vertical are short in comparison to the tension-rods, which are generally fixed at about 45°; while the struts and ties for a Warren girder are placed at an angle of 60°. The roof girder C in the Appendix is a lattice girder; and this has a somewhat better appearance than the others. It is very suitable for short spans when carrying light loads. Trellis girders are used extensively for light footbridges, as with the floor carried on the bottom flange, the two side girders take the place of handrails.

The stresses on braced girders are generally obtained by stress diagrams; those on girder C are obtained in this manner. In braced girders, it is particularly important that the load should be carried directly under or over a strut. Where this is impossible, and the load—either concentrated or distributed—is carried on the flanges between the struts, in addition to providing for the tensile or compressive stresses shown by the diagram, the stresses due to the load, taken as a beam whose length equals the distance between the struts, must be calculated, and the flange strengthened accordingly.

The compression flanges of braced girders require a good deal of stiffening. Where possible (as in deep bridges), this is best carried out by diagonal bracing from girder to girder on both top and bottom flanges. Raking struts should be employed where diagonal bracing cannot be used or additional material put into the compression flange, preferably as angles riveted on the outer

APPENDIX TO PAPER ON "STRUCTURAL STEEL-WORK FOR GAS-WORKS."—By W. S. SMART, of Saltley.

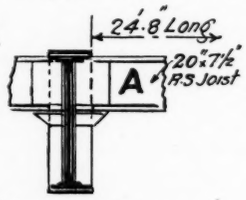
CALCULATIONS FOR PURIFIER-HOUSE.


ROOF PRINCIPAL
8'·8"
26'·0" CENTRES OF COLUMNS
CENTRES OF PRINCIPALS
FLANGE 2 L^s 3"x3"x3/8"
½ PRINCIPAL
Load on One purlin 7'1" sq ft x 33 lbs = 11 Cwts
3"x7/16"
2½"x5/16"
4"x5"x½" Tee Rafter
ROOF GIRDER C
Purlins 2"x1½"x¼" Angles 10½" apart
2½"x3/8" flat
3"x3"x7/16" angle STRUT
2½"x7/16" flat
12'·0" Rise OF HOUSE
2½"x2½"x7/16" STRUT
4"x7/16" flat
3"x7/16" flat
22'·6"
ROOF LOAD = 46'x8'⅓' = 400 sq ft area. Wind at 22 lbs = say 80 Cwts. Purlins & principal say 26 cwt slates 54'x8'⅓' = 468 sq ft at 8 lbs = say 34 cwt allow contingencies say 10 cwt Total:- 7 Tons see diagrams
CENTRE LINE
LOAD ON FLOOR
Taken as 3 Cwt per sq ft including weight of concrete floor
20'·0"
1 Braced
9'·0"
9'·0"
4'·6"
16"x9/16 flange plates
16"x5/8" Flange plate 24'·0" Long
A
2 L^s
4½"x3½"x5/8"
A
B
9/16" Web
3/8" Web
7/8
Rivets 3" pitch
7/8" Dia rivets
4" pitch
Joint in Bed
32'·0"
15'·0"
2 Channels 12"x3½"x33 lbs per ft
2 Flange plates 14"x½"
LONGITUDINAL GIRDER A span 24⅔ ft. centres 9 ft = 222 sq ft at 3 Cwt, say allowing for own weight 34 Tons
CROSS GIRDER B. 4 Loads A¹ ² ³ ⁴ each 34 tons allow for floor carried on girder flange & own weight say 14 tons Total on girder 150 Tons
ROOF GIRDER C 2 Loads from principal each 3½ Tons Own weight 1 Ton Total 8 Tons
MAIN COLUMN From end of girder B = 75 tons From outer girder D = 17 Tons. Roof girder 12 " own weight 2 Tons Total 106 Tons

PART CROSS SECTION THRO' HOUSE
Scale 3/16 Inch to One foot

Longitudinal Girder A.—Load 34 tons distributed. $M = \frac{W \times L}{8} = \frac{34 \text{ tons} \times 296''}{8} =$ 1258 inch tons R for 20" × 7½" R.S. joist = 167·1 and $\frac{M}{R}$ = stress per sq. in. $\frac{1258}{167 \cdot 1} = 7 \cdot 5$ tons.

Cross Girder B.—Calculate M for each load and combine them on diagram to obtain maximum. M = Loads A^2 and $A^3 = 34$ tons concentrated $M = \frac{W \times E \times F}{L}$ $= \frac{34 \text{ tons} \times 16\frac{3}{4} \text{ ft.} \times 25\frac{3}{4} \text{ ft.}}{42\frac{1}{2} \text{ ft.}} =$ 345 ft. tons each. A^1 and $A^4 = \frac{34 \times 7\frac{3}{4} \text{ ft.} \times 34\frac{3}{4} \text{ ft.}}{42\frac{1}{2} \text{ ft.}} =$ say, 215 ft. tons each. Distributed load B^1 = 14 tons = $M = \frac{W \times L}{8}$ $= \frac{14 \text{ tons} \times 42\frac{1}{2} \text{ ft.}}{8} = 74$ ft. tons. From diagram (max.) M at centre = 912 ft. tons. The flange stress $= \frac{M}{\text{depth of girder}} = \frac{912}{4} =$ 228 tons. Say 7 tons per sq. inch working stress for steel $= \frac{228}{7} =$ 32·6 net sq. in. required in each flange. Say flange built up of 2 angles each 4½" × 3½" × ⅝",



SECTION

2 flats 16" × 9/16" and 1 flat 16" × ⅝". Gross area = 37·2 sq. in. deduct 8 rivet holes = 4·7 sq. in. = 32·5 net sq. in. provided. All the flange need not extend the full length of girder. To find positions where sections may be stopped set off on line X Y net. areas of sections. Join Y Z and draw from U and V lines parallel to Y Z. From the intersection of these on X Z draw horizontal lines cutting diagram of moments at points 1, 2, 3, and 4, which are the positions required.

Web Plate.—Shearing stress (max.) = ½ total load = 75 tons, say web plate 9/16" thick area = 48" × 9/16 = 27 sq. in.

BENDING MOMENTS ON BEAMS (MAX)

Load central	Bending moment	$M = \frac{W \times L}{4}$
" out of centre	" "	$M = \frac{W \times E \times F}{L}$
" distributed	" "	$M = \frac{W \times L}{8}$

SHEARING & BEARING VALUES FOR BOLTS & RIVETS

Dia of	Single shear	3/8" plate	7/16" plate	½" plate	9/16" plate	Bearing
Rivet ⅝"	in tons 1·53	2·34 tons	2·73 tons	3·1 tons	3·51 tons	Double
" " ¾"	" " 2·2	2·81 "	3·28 "	3·75 "	4·21 "	shear value
" " ⅞"	" " 3·0	3·28 "	3·82 "	4·37 "	4·92 "	1¾ times single

ULTIMATE STRENGTH OF COLUMNS

Ends fixed	Ends free
$\frac{50{,}000 \text{ lbs}}{1 + \frac{(12L)^2}{36{,}000 I^2}}$	$\frac{50{,}000 \text{ lbs}}{1 + \frac{(12L)^2}{18{,}000 I^2}}$
Divisor for factor of safety	
$4 + \cdot 01 \frac{12L}{I}$	$4 + \cdot 015 \frac{12L}{I}$

Where L is unsupported length in feet & I is least radius of gyration 18,000 & 36,000 are constants

The Moments of Inertia of a beam is a geometrical quantity, its value depending solely upon the shape & size of the section & the position of the axis about which it is taken. The Moments of Resistance R equals the $\frac{\text{MOMENTS OF INERTIA}}{\text{DISTANCE FROM AXIS TO EXTREME FIBRES}}$ & Radius of Gyration $I = \sqrt{\frac{\text{MOMENTS OF INERTIA}}{\text{AREA}}}$

The Standards Committee handbook gives these properties for ordinary sections & also instructions for calculating compound sections.

$\frac{75 \text{ tons}}{27 \text{ sq. in.}} = 2{\cdot}8$ tons stress per sq. in. Pitch for rivets to web Bearing value $\frac{7}{8}$" dia. rivet on $\frac{9}{16}$" plate = 4·9 tons = $\frac{75 \text{ tons shear}}{4{\cdot}9 \text{ tons bearing}}$ = say 16 rivets. These are required in a length equal to the depth of girder, viz., 48" = 3" pitch. Shear (max.) between A^1 and A^4 = 38 tons, say, web plate $\frac{3}{8}$" thick; area 48" × $\frac{3}{8}$" = 18 sq. in. $\frac{38}{18} = 2{\cdot}1$ tons stress per sq. in. Bearing value $\frac{7}{8}$" rivet on $\frac{3}{8}$" plate = 3·28 tons = $\frac{38}{3{\cdot}28}$ = say 12 rivets = 4" pitch. Stiffeners need not be closer than $\sqrt{\frac{5}{K}} - 1 \times 3000\,t^2$, when K = shear stress sq. in. on web and t thickness of web plate. This gives 27½" for $\frac{5}{16}$" web and 25" for $\frac{3}{8}$" web.

Roof Purlins.—Distributed load ·11 tons $M = \frac{W \times L}{8}$ = $\frac{\cdot 11 \text{ tons} \times 100"}{8} = 1{\cdot}37$ inch tons. Angle 2" × 1½ × ¼ weighs 2·8 lbs. per foot. Handbook gives R as ·16 for 2" × 1½" angle at 2 lbs. per foot, so that $\frac{16 \times 2{\cdot}8}{2} = {\cdot}22$ R for 2" × 1½" × ¼ angle $\frac{M}{R} = \frac{1{\cdot}37}{{\cdot}22} = 6\frac{1}{4}$ tons stress per sq. in.

Roof Principal Rafter.—Stress from Diagram II. = 7½ tons compression, unsupported length 8 ft. Assume 4" × 5" × ½" Tee I = 1·5, ultimate strength per sq. in. ends fixed = $1 + \frac{50{,}000}{32{,}000 \times I^2} = 44{,}600$ lbs. factor of safety = $4 + {\cdot}01\,\frac{12 \times 8}{1{\cdot}5} = 4{\cdot}64$ and $\frac{44{,}600}{4{\cdot}64} = 4\frac{1}{4}$ tons. It will therefore require $\frac{7{\cdot}5}{4{\cdot}25} = 1{\cdot}8$ sq. in. from 4 × 5" × ½ tee to resist compression. Area of 4" × 5" × ½" = 4·2 sq. in. = 4·2 − 1·8 = 2·4 sq. in. left to resist beam stresses. Load from purlins say ·9 tons $M = \frac{W \times L}{8} = \frac{\cdot 9 \text{ tons} \times 100}{8}$ = 11·2 inch tons R of 4" × 5" tee 3·2 sq. in. area = 2·2 sq. R for tee 2·4 sq. in. $\frac{2{\cdot}2 \times 2{\cdot}4}{3{\cdot}2} = 1{\cdot}6$ R and $\frac{M}{R} = \frac{11{\cdot}2}{1{\cdot}6} = 7$ tons stress per sq. in.

Strut P.—Stress from Diagram III. = 2 tons compression, unsupported length = 7 ft., ends free. Assume 3" × 3" × $\frac{7}{16}$" angle I = ·6 and $1 + \frac{50{,}000 \text{ lbs.}}{\frac{(12 \times 7)^2}{18{,}000 \times {\cdot}6^2}} = 23{,}800$ lbs. F of S = $4 + {\cdot}015\,\frac{12 \times 7}{{\cdot}6} = 6{\cdot}1 = \frac{23{,}800}{6{\cdot}1}$ = say, 1¾ tons safe load per sq. in. Area of 3" × 3" × $\frac{7}{16}$" L = 2·4 × 1·75 = 4·2 tons safe load on strut.

Strut Q.—Stress from Diagram III. = 1¼ tons compression. Assume 2½" × 2½" × $\frac{5}{16}$" angle area, 1·4 sq. in., safe load from formula, say, 4 tons.

Main Tie.—Stress from Diagram II. = 6¾ tons tension, say, flat 4" × $\frac{7}{16}$" gross area = 1·75", net area deducting ·4 for $\frac{7}{8}$" dia. hole = 1·35, × 6 tons per sq. in. = 8·1 tons safe load bearing value $\frac{3}{4}$" dia. rivet on $\frac{7}{16}$" plate = 3·26 tons, 3 rivets = 9·84 tons.

Centre Tie.—Stress from Diagram II. = 4¼ tons tension, say, flat 3" × $\frac{7}{16}$", gross area = 1·3 net, less ·4 = ·9 × 6 tons sq. in. = 5·4 tons safe load, 2 rivets give 6·5 tons.

Counter Tie (1st).—Stress from Diagram III. = 2¼ tons tensile, say, flat 2½" × $\frac{7}{16}$", gross area 1 sq. in. net, less ·4 = ·6 × 6 tons = 3·6 tons safe load.

Counter Tie (2nd).—From Diagram III. = 1½ tons tension, say, flat 2½" × $\frac{5}{16}$", gross area, ·78 sq. in., less ·3 = ·48 net × 6 tons = 2·8 tons safe load.

Roof Girder.—Maximum stress from Diagram IV. occurs in bottom flange, viz., 15¾ tons tension, say, 7 tons per sq. in. working stress, $\frac{15\frac{1}{2} \text{ tons}}{7} = 2{\cdot}3$ net sq. in. required, say, for each flange. Assume 2 angles 3" × 3" × ⅜", gross area 4·2, deduct 2 rivet holes ·64 = 3·56 net sq. in. provided.

Compression Diagonal Bracing.—Stress, 2·9 tons, unsupported length 12", assume flat 3" × $\frac{7}{16}$", I=·12 ends free, from formula the safe load is 3 tons per sq. in., area = 1·3, safe load=1·3 sq. in. × 3 tons = 3·9 tons, 1 rivet ⅞" dia. $\frac{7}{16}$" bearing=3·28 tons. Adopt similar section for tensile diagonal bracing. Diagram IV. shows that central bay diagonal bracings are not stressed, but bracings will be necessary, say, 2½" × $\frac{5}{16}$" flats.

Main Columns.—Total load on bottom portion = 106 tons. Assume box section column built up of 2 channels 12" × 3½" × 33 lbs. per foot with two flange-plates 14" × ½" unsupported length=17 ft., ends free. Least I = 4 breaking weight from formula = 43,800 lbs. per sq. in. factor of safety from formula = 4·8 and $4\frac{3}{4}\frac{8}{8}\frac{0}{0}$ lbs. = say, 4 tons safe load per sq. in. Gross area of column = 33·2 sq. in., deduct 2 sq. in. for 4 rivet holes one side of column only; 31·2 sq. in. net, and at 4 tons per sq. in. = 124·8 tons safe load on column. For upper portion of column continue channels braced with 2½ × $\frac{5}{16}$" flats.

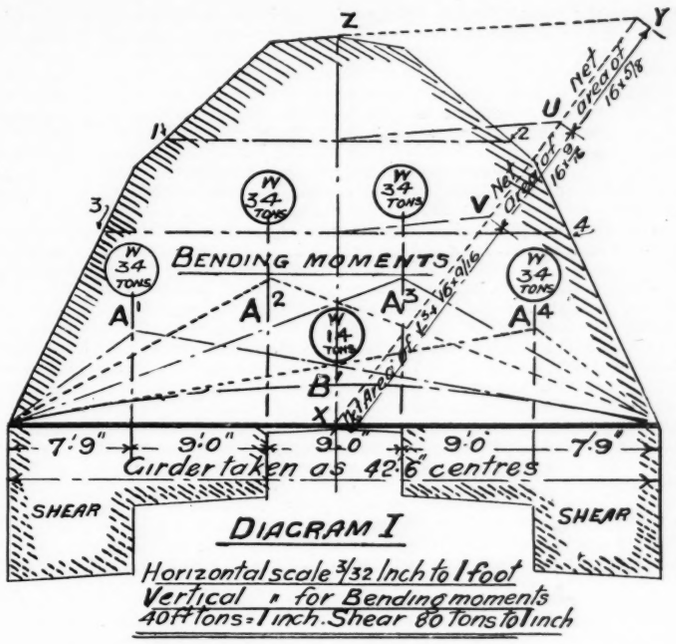


DIAGRAM I

Horizontal scale 3/32 Inch to 1 foot
Vertical " for Bending moments
40 ft Tons = 1 inch. Shear 80 Tons to 1 inch

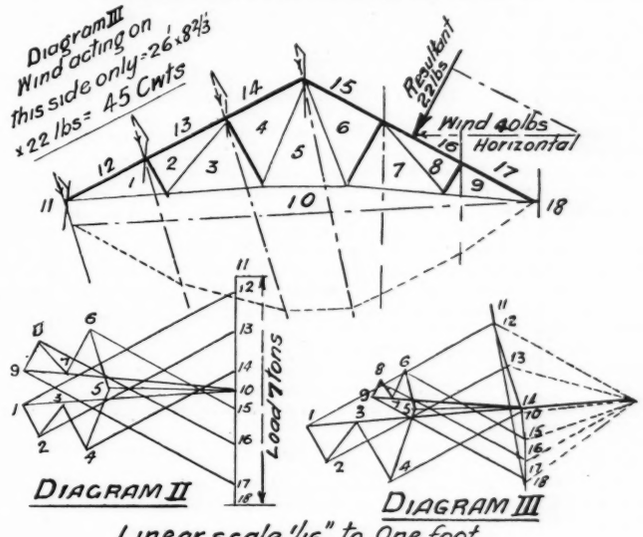


DIAGRAM II

DIAGRAM III

Linear scale 1/16" to One foot
Force " 5 tons to One inch

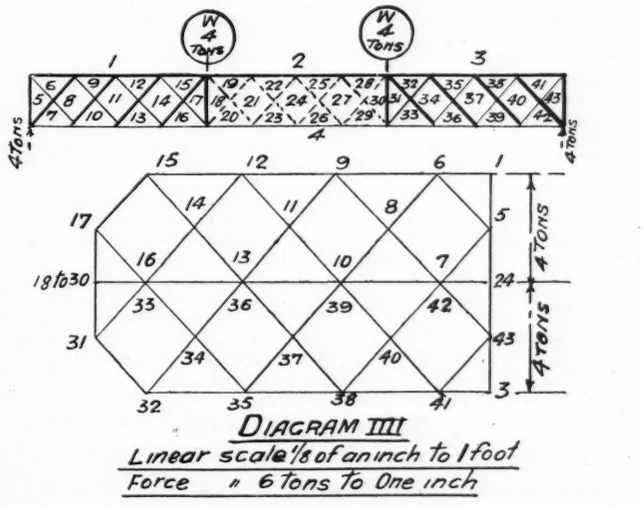


DIAGRAM IIII

Linear scale 1/8 of an inch to 1 foot
Force " 6 tons To One inch

edge of the flange-plates. Girders A and B are considerably stiffened by the concrete floor; and girder C receives sufficient lateral support from the roof principal. The working stress on these girders should not exceed 7 tons per square inch; this being reduced (in a somewhat similar manner to that for the rolled girders) when subjected to live loads or vibration. The flange-plates should not project beyond the edge of the angle more than 5 inches.

Steel roofs are gradually displacing the old-fashioned timber king and queen post roofs, and also composite roofs which were generally made with timber rafters, cast-iron struts, and wrought-iron ties. The light, shallow curved roofs—known as the Belfast type—with a felt covering laid on boards is an exception to this statement, as this type of roof is largely used for factories, &c.

The question of covering is a very debatable point. The choice in gas-works lies between slates, tiles, or corrugated iron sheets—the latter either black or galvanized and painted. There is but little difference in the actual cost of these three coverings, but the slates and tiles need a very much stronger supporting framework, which increases the total cost of the building from 4d. to 6d. per square foot of area covered over that of the cost of a corrugated iron covered building. Whether the saving in the first cost is more than balanced by the longer life of the slated and tiled coverings, is to a certain extent an open question. Principals carrying corrugated iron sheets are spaced from 10 to 14 feet centres; and when carrying slates, from 6½ to 9 feet centres. Angles about 3 inches by 3 inches by ⅜ inch should be used as purlins for sheeted roofs; and these should be spaced about 6 ft. or 7 ft. 6 in. apart on the back of the rafters and as near as possible over a strut. The galvanized sheets are fastened to the purlins by galvanized hook bolts about 12 inches apart. Small angles are used for slate laths spaced 10½-inch centres. Sometimes they are fitted with timber for nailing the slating on; but at the Birmingham works they are held to the laths by lead clips. This way has always been found satisfactory.

Before proceeding to settle the size of the slate laths, it will be necessary to decide the amount of the horizontal wind-pressure acting on the roof. There is little or no reliable information as to what this is when distributed over a large surface. Anglin recommends a maximum of 40 lbs. per square foot of vertical surface; and this has been adopted in the calculations. This amount must be resolved so as to obtain its normal component, as the maximum pressure is exerted at right angles to the surface upon which it acts. This is generally computed by the formula obtained from experiments by Hutton; and in this instance it equals approximately 22 lbs. per square foot. The 40 lbs. is the minimum horizontal pressure which should be adopted; and it is often taken as high as 56 lbs. per square foot. For contingencies, 10 cwt. has been allowed to each principal, so that we shall be quite safe in taking the wind pressure at 40 lbs. From the calculations, it will be seen that a 2 inch by 1½ inch by ¼ inch angle has been adopted for slate laths. The leg should point towards the shoe of the rafter; but this is often fixed pointing towards the apex, which greatly reduces its strength, owing to its effective depth being so much less. If the 2 inch by 1½ inch by ¼ inch slate lath were fixed in the opposite direction to that shown, its strength would be reduced by about one-third.

Roofs are roughly divided into curved and pitched. Curved roofs have a somewhat better appearance than pitched roofs; but except for spans up to 30 feet and over 75 feet, they are not so economical, and to enable slates to be fixed on curved roofs, secondary rafters must be employed.

Flats, angles, or tees may be used for the tension-rods in the bracings; but round rods should not be employed. The forgings required when round rods are used are very expensive; and the cost for labour is generally twice as much as for flat rods. In addition to this, there is always the risk of a bad weld, however much care may be used. The rise of the roof is generally made about one-fourth of the span; but a steeper pitch should be given to roofs carrying ceilings—where the roof must be absolutely watertight. Sheeted curved roofs may be made as low as one-fifth the span.

The stresses on curved and pitched roofs are generally obtained by the graphic method. This method is shown in the Appendix, where it will be seen two stress diagrams have been drawn. In Diagram II., the wind is assumed to act vertically downwards all over—a very unlikely occurrence, but on the safe side. In Diagram III., the wind is assumed to act at right angles to the slope, and therefore only affects one side. The maximum stresses from either diagram are adopted. The stresses for curved roofs are obtained in a somewhat similar manner; but it should be particularly noticed that the wind, when acting on different sides of a curved roof, changes the character of the stresses in some of the bracings from tensile to compressive, and *vice versâ*. It is thus necessary to design all the bracings as struts; and this adds to the weight of the principal.

As explained when dealing with braced girders, loads occurring on the rafter between the supporting struts must be calculated as beams, in addition to the compressive stress shown on the diagram. The Appendix shows these calculations, which do not call for comment. The point, however, is important, as the writer has often seen sections used for rafters under these conditions which would only just carry the load from the purlins as a beam.

The wind should be considered as a live load; and for this reason you will notice the safe stresses on the material have been calculated at 6 tons per square inch. Diagonal wind-ties should extend from the shoe to the apex of the principals; but in the purifier-house shown it would be unnecessary for them to extend throughout the roof, owing to the support rendered by the angle slate-laths, and if fixed to the first three bays at each end of the building, it would be all that would be required. This would also apply to roofs with corrugated iron coverings and angle purlins; but when timber purlins are used, the wind-ties should extend the whole length of the roof.

Hipped ends to roofs increase the cost considerably, and should be avoided where possible.

Steel columns are gradually superseding cast-iron columns, especially where vibrations or rapidly moving loads occur. They are practically as cheap, and are much more reliable—not being subject to the uneven thicknesses and cooling stresses inseparable from cast-iron. Unfortunately it is impossible to make a steel column look so nice as a well-designed cast-iron one.

Solid sections—such as channels, joists, &c.—are not economical when their unsupported length exceeds about forty-five times their least flange width. A channel is about 5 per cent. stronger than a joist of equal size and weight, owing to its greater minimum radius of gyration. By the addition of flange-plates to joists and channels, &c., a great variety of columns may be made up of practically any desired strength.

The ⊐ bar column is a favourite with American engineers for their skeleton framed structures, owing to the small amount of riveting it requires and the facility it offers for four-way connections.

The strength of columns varies with the manner in which their ends are fixed; and formulæ for free and fixed ends are given in the Appendix for each condition. Struts or columns with fixed ends should be so firmly connected at both ends that this attachment would not be severed, when the column was subjected to its ultimate load. Free ends (or rounded, as they are often termed) are attached by pins, or fit in rounded socket bearings in which they are free to turn. For ordinary columns, owing to the impossibility of obtaining a perfectly level base, or one which would not yield before the column itself broke, it is better to assume the ends to be free, and calculate accordingly. The length of the column in the formula does not necessarily mean the total height of the column, but is the distance of its unsupported length.

The column adopted for the purifier-house is built up of two channels with flange-plates to above the floor-line, and then braced. The bottom portion may be filled in with concrete, which would prevent rusting in inaccessible places for painting.

The column formulæ given only apply to dead loads and loads carried on the centre of the column. Where there is much eccentricity of loading, or where the loads are subject to sudden changes, allowance must be made. The column shown in the Appendix has a considerable margin between safe and calculated loads, as the 75 tons brought on it from the girder B is out of the centre of the column. Columns carrying gantry cranes or high single-span roofs also require a large margin of safety.

It is always considered good practice to increase the factor of safety with the length of the column, owing to the greater inability of long columns or struts to resist cross-strains; and the formulæ given in the Appendix are recommended.

The pitch of the rivets for structural work should not exceed 6 inches, or sixteen times the thickness of the thinnest outside plate, or thirty times this thickness at right angles to the stress; nor should they be pitched closer than three diameters of the rivet. The distance between the edge of the bar and the centre of the rivet-hole should not be less than one-and-a-half times the diameter of the rivet. Except for packing-pieces, &c., no material should be less than $\frac{5}{16}$-inch thick; but it is better to make ⅜-inch the minimum thickness for plate-girder webs.

Manufacturers' lists give the maximum length to which bars, angles, &c., can be rolled; and where these lengths are exceeded and joints are necessary, they must be covered by plates having the full area of the section joined, and of sufficient length on either side of the joint to obtain the necessary number of rivets, so that their combined shearing or bearing value will not be less than the safe stress on the bar.

It will be noticed that, in the calculations given in the Appendix, they have in most instances been taken to only one place of decimals, while for others the nearest whole number has been taken. When it is remembered that the rolling-mills claim an allowance of 2½ per cent. over or under specified weight for all sections, the futility of working out the calculations to three or four places of decimals will readily be seen.

Discussion.

The PRESIDENT, in proposing a hearty vote of thanks to Mr. Smart, remarked that the paper had furnished ample evidence of the advantage members would derive from having the contributions printed. There was more in the paper than could possibly be assimilated in the half-hour that had been occupied by reading it. He was sure, having some knowledge of construction work, that the communication would well repay careful study. It had been splendidly put together; and when they thought of the time that had been given by the author to its preparation and to that of the appendix, they must agree that it showed praiseworthy loyalty to the Association. The question of the designing of work was most important; and as young engineers,

they ought to pay particular attention to the subject. Most of the structures—though, of course, this was not the case with gasholders—were fairly simple; and it was worth while to undertake the study required to carry out the work. Mr. Smart spoke of Bessemer steel not being quite reliable; but this, he (the President) thought, depended upon where it was obtained. Bessemer steel was different now from what was formerly the case. It was made by blowing, and it used at one time to be not very possible to tell exactly the composition; but now, by means of careful analysis and the employment of large mixers, this was ascertainable to a very small decimal. He thought, therefore, that the author's remarks on this head were not quite justified. Then Mr. Smart did not agree with the inclusion in a specification of such words as "in the best and most workmanlike manner;" he thought everything ought to be specified. He (the President), on the contrary, believed that the fewer fussy restrictions there were in a contract, the better it was. If the work was properly looked after, it would be done in the best manner. He did not agree also with what Mr. Smart said about punching. His own opinion was that drilling or punching and subsequent reaming was the only satisfactory way of doing steel work. He believed that Professor Unwin said it decreased the strength of steel about 8 or 9 tons per square inch to shear it by means of a punch. Of course, the weakness did not extend very far in; and if the hole to be made was first of all punched out and then reamed, it gave a very satisfactory job. The author had made some very proper remarks about the deficiency of rolled joists, which were used too much now. They were really most inefficient for anything over the smallest lengths.

Mr. S. T. Smith (Walsall), who seconded the proposal, remarked that there was really very little to discuss then; the paper needed to be taken home and read and considered before one could go fully into the matter. There were, however, two things which attracted his attention. First as to the Bessemer steel analysis. Last year he went over various steel works; and he was informed that the makers could tell to a decimal place—in fact, to hundredths—the composition of the steel they were turning out. So that he begged rather to differ from Mr. Smart in that respect. Another remark was about the painting of steel work. He thought that this was a thing that really wanted more attention on a gas-works than any other work. If steelwork was not properly looked after, it would very soon go—more especially in connection with purifier-houses where oxide was used. There it required great attention.

Mr. G. W. G. Tatam (Saltley) remarked that, though he was unable to say much about construction, it seemed to him, for a thing that should be an exact science, the variations in design were somewhat too numerous. He thought it would be better for the industry, and for the manufacturers, if they could have some standard design for girders and such like; but this was merely a suggestion on his part. The ⊤ bar standard described seemed to be admirably adapted for use with Cutler's radial and tangential system of guide framing. As to the efficiency of Bessemer steel, he was pretty well certain that the variations some years ago were purely due to the method of judging when the blow was over, or how it was proceeding. They used simply to get a foreman to stand by the converter; and by the length and colour of the flame, he knew approximately when the metal had sufficient blow. Now the matter was coming in for much more scientific treatment; and he thought the present-day value of Bessemer steel was due to the scientific thought given to this method of production.

Mr. T. R. Murray (Saltley) said the paper did not deal with a very controversial subject; being governed by fixed axioms with which they all agreed—or, at least, did not dare to disagree. One or two things, however, suggested themselves to him. As to corrugated iron and cement concrete arches between the joists, this method of flooring was open to considerable objection as regarded the use of corrugated steel. It corroded very rapidly, and the arch was seriously weakened thereby. They also found such arches were particularly weak at the crown. As regarded the tendency to perforation, expanded metal work was somewhat better, as the steel was embedded in the concrete. A preferable type of flooring for purifiers would be steel troughing filled in with concrete. This would probably be more expensive, and he thought it would be more durable. As to wind pressures, there was no doubt the state of knowledge was most unsatisfactory. In 1899, Mr. Irminger read a paper before the Institution of Gas Engineers which was well worth perusal. He showed that with an ordinary pitched roof, the side opposite to that on to which the wind was blowing was actually in vacuum; and this being so, it must materially alter the stresses of the members on the principals. This upset all their preconceived ideas as to wind pressure. He also cited an instance in which a holder, during a storm, was actually lifted, so that its pressure was reduced. Tests showed that under such conditions a holder roof was in vacuum, and that when it was exposed to a gale it was absolutely relieved, rather than the stress added to. If they could investigate further some of these phenomena, it would repay them—particularly as regarded those dealing with graphic statics.

Mr. C. Meiklejohn (Rugby) endorsed all that had been said about the interesting paper. The Association was suggested as being an educational one; and he thought that from this point of view they had made a splendid start. He could not say how much pleasure it had afforded him to be present, and to listen to the proceedings. Both the paper and the discussion were a credit to the Association; and he heartily congratulated them on the successful future that seemed to be assured.

The vote having been accorded with acclamation,

Mr. Smart thanked the members. He remarked that most of the discussion seemed to have centred round the question of Bessemer steel. He could only say he put what he did in the paper, because many engineers, in drawing up their specifications, said distinctly that the steel must be from the open hearth. Referring to what Mr. Tatam and other members had said, he believed the objection to Bessemer steel arose from the fact that it was made in about twenty minutes—the blow was completed in this time; and if it was kept on (say) three seconds longer than it should be, the metal was practically waste. It was for this reason that it was feared the steel might not be what it should. In the open hearth method, it took twelve hours to oxidize the steel; and they could shut off the gas and make a practical analysis. This was why the latter system was always supposed to be more reliable. In the one case it was a question of two or three seconds; and in the other, of half-an-hour. As to other remarks, no doubt punching and reaming made better work; but the question was whether it was worth paying for. If a roof fulfilled the purpose for which it was designed, why should they add to its cost? He would venture to point out that a great difference of opinion existed regarding Professor Unwin's view as quoted by the President. With reference to what Mr. Murray had said, he admitted that corrugated arches did rust away, unless properly protected by painting, &c. The trough flooring mentioned was not economical for comparatively light loads; but otherwise it made a very good floor.

Will of the Late Mr. George Bray.

Probate of the will, with one codicil, of the late Mr. George Bray (whose death was recorded in the "Journal" for Aug. 29) has, the "Yorkshire Post" says, been granted to Mr. James William Close, Chartered Accountant, Leeds, Mr. David Grimshaw, Sharebroker, Leeds, and the testator's sons, Mr. John William Bray and Mr. Arthur Bray, who are Executors and Trustees. The will is dated Jan. 13, 1902, and the codicil Jan. 28, 1903. Legacies of £500 each are given to Mr. Close and Mr. Grimshaw; and there are further legacies amounting to £1800 given to relatives, friends, and servants. Subject to a provision as to the testator's residence, the Trustees are to sell and convert the estate into money; and, after payment of expenses, legacies, &c., are to hold the residuary estate in trust for his children, Mr. John William Bray, Mrs. Annie Simpson, Mr. Arthur Bray, Miss Florence Bray, and Mr. George Bray, in certain proportions. By the codicil, the shares given to Mr. John William Bray and Mr. Arthur Bray by the will are to be in addition to property valued at £12,000 and £10,000 given to them respectively on the formation of the testator's business into a private company. The net value of the real and personal estate is £181,744 10s. 11d. Estate duty and interest amounting to £10,695 has already been paid; and there will be further estate settlement and legacy duty payable.

The position of Chairman of the Halifax Gas Committee, held by the late Alderman Wadsworth, is to be taken by Mr. Joseph Collinson, the present Vice-Chairman; while Mr. I. H. Skinner will be promoted to the vice-chair.

Mr. C. J. Howell Thomas, Estate Agent and Valuer to the Swansea Corporation, has been appointed, out of 133 applicants, Estate Clerk to the Metropolitan Water Board, at a salary of £500 per annum. Before going to Swansea, Mr. Thomas was with Messrs. Chinnock, Galsworthy, and Chinnock.

Mr. T. A. Pallister, Works Secretary of Messrs. Ashmore, Benson, Pease, and Co., Limited, has been elected a Fellow of the Chartered Institute of Secretaries; and he is also a member of the North-East Coast Association of Secretaries. He completed 21 years' service with the firm in September last.

Mr. W. H. Forde, the Director next in seniority, has been elected Chairman of the Hoylake and West Kirby Gas and Water Company, in succession to the late Dr. J. Kellett Smith, whose death is recorded elsewhere. Mr. Alfred Tyrer, one of the Directors of the Liverpool United Gas Light Company, has been chosen to fill the position of Vice-Chairman.

We learn that Signor Cav. Giacomo Beria has been appointed Manager of the Turin Gas Company, in succession to the late Signor Cav. Luigi Beria, whose death was announced in the "Journal" for the 31st ult.; and that the Directors have nominated Signor Vittorio Bonino, a colleague of the deceased, Technical Director of the Company.

The many friends of Mr. J. Phillips, the Secretary of the Bristol Gas Company, will be glad to learn that he is recovering from his recent accident (see *ante*, p. 315), and hopes soon to have the benefit of a change of air by going to the seaside. The effects of the accident were, it seems, more serious than was generally known; and it will be some time before Mr. Phillips's recovery is complete.

SCOTTISH JUNIOR GAS ASSOCIATION.

Western District.

Members of the Scottish Junior Gas Association—Western District—held one of their monthly meetings in the New Technical College, George Street, Glasgow, on Saturday evening. Mr. JAMES BELL (Airdrie), the President, occupied the chair; and there was a fair attendance.

COAL AND COAL MINING.

Mr. J. SIMPSON (Glasgow) read a paper on the above subject. He began by pointing out how important had been the part played by coal in the world's history, and how largely it had contributed to the welfare of this country during the past century. As an article of domestic fuel it was indispensable; and with it there was scarcely anything that could not be accomplished. Without it, we should be driven back to the laborious times of our forefathers. Everybody knew what coal was, but very few could accurately define it. A striking instance of the difficulty of doing this was furnished by the famous Torbanehill mineral lawsuit in the Court of Session in 1853. But though coal could not be defined, it could be classified. This was variously done according to its chemical composition, its behaviour when heated, and its geological position or origin. All coal contained carbon, hydrogen, oxygen, and nitrogen, forming the carbonaceous or combustible portion, with a quantity of ash, which varied considerably in different coals. In classifying coal, they had: (1) Peat; (2) lignite, or brown coal; (3) bituminous coal; and (4) anthracite. Peat was supposed to represent the first stage in the conversion of vegetable matter into coal; and lignite was a vegetable matter incompletely mineralized. Bituminous coal might be said to be the most important class of coal. Its proportion of carbon varied from 80 to 90 per cent.; the amount of hydrogen, from 4½ to 6 per cent.; and the oxygen varied within much wider limits. The bituminous class might be said to include all ordinary coal, such as splint, ell, main, virtuewell, drumgray, virgin, hiltongue, and all others of a flammable nature, including cannel. It was for the most part non-coking. Much of this class of coal was used in the manufacture of gas. Anthracite was a very slow-burning coal, with a small amount of flame, producing intense heat and no smoke. It was generally known as "smokeless" coal.

Having offered a few remarks on the origin of coal, and pointed out that its use was unknown to the ancients, Mr. Simpson proceeded to show that the suitability of coal for any particular purpose depends upon its chemical composition, its behaviour when burning, its specific gravity, its hardness or softness, and the amount of heat it would give off when burnt. He said all coal contained sulphur, and more than a certain proportion of it rendered coal unfit for use in some cases. The quantity of moisture, the amount of ash left after burning, and the character of the flame, often determined the fitness or unfitness of coal for particular purposes. The use of coal for gas making was a point on which it would be presumption on his part to say much in the presence of so many gentlemen who had been in the habit of employing and testing it for years; but perhaps he might be allowed to remark that coal used for this purpose should contain as large a proportion of hydrogen as possible, with little sulphur, and a minimum of ash. It should be fresh wrought and dry, for all coal, whether exposed to rain or sunshine, deteriorated to some extent. If several classes were used, they should be judiciously mixed. With regard to how coal should be put into the retorts—whether in light or heavy charges—to produce the best results, was an open question, and one upon which gas engineers were not agreed. This was a matter upon which everyone must act according to his own experience and observation.

Passing on to the second branch of his subject, Mr. Simpson showed how the art of mining had been practised from the remotest times. The earliest coal mines were, he said, worked in a very modest fashion; the tools used being the pick, the hammer and the wedge. Blasting was quite unknown; and the windlass was the only machine for raising the coal. In Scotland this was omitted; the coal being borne up ladders on the backs of women. Having described the severe conditions under which colliers worked down to the reign of George the Third, the author proceeded to describe the process of ascertaining the existence of coal in the earth and the different methods of "winning" it. He said the "long wall" system, which consisted in taking the whole of the coal along the face of the seam, and filling the space behind with rubbish, which was allowed to settle, was, when well planned, the safest, both as regards facility of ventilation and reduced liability to accidents from falls. Up to the end of the Seventeenth Century, water was the great enemy of the coalowner; but from the time of the invention of the steam-engine by Newcomen, this had been under control. As pits began to get deeper, another great danger—fire-damp—presented itself; and, in the history of coal mining, probably the most important chapter was that recording the long struggle with this deadly foe. At the beginning of the last century, however, Mr. John Buddle, the Manager of the Wallsend Colliery, effected great improvement in the ventilation of mines by "splitting" the air and using more than one downcast shaft. Then came the production by Sir Humphry Davy of his well-known safety lamp; and few inventions had been the means of saving more lives. The celebrated George Stephenson also invented a safety lamp which was still in use. Strange as it might seem, explosions happened more frequently after the introduction of the safety-lamp than before. The men seemed to look upon it as a protector from, rather than as a detector of, danger. But, notwithstanding the terrible accidents which happened from time to time, more resulted from falls than from explosions.

In conclusion, Mr. Simpson gave some figures showing the production of coal in the United Kingdom. In 1850, the quantity was 49 million tons; in 1860, 80 millions; in 1870, 110 millions; in 1880, 147 millions; in 1890, 181 millions; and in 1900, 225 millions. It would be seen from these figures, he said, that our coal supply might run out much more quickly than was expected.

Discussion.

The PRESIDENT said that, though the paper was not directly connected with the gas engineering profession, still, without coal they could not do very much; and he was sure they had all greatly enjoyed Mr. Simpson's paper. He thought it would be a good thing if the Council could arrange for the members to visit an up-to-date colliery, where they could see the finest haulage and pumping machinery.

Mr. J. LOWE (Glasgow) said it was quite fitting that, at the beginning of their session, they should give some consideration to the substances which formed the raw material of their industry. And not of theirs only; for, as Mr. Simpson had told them, coal had played a most important part in the world's history. With regard to the question of an exact definition of coal, he had heard it called "bottled sunshine;" and this seemed to him to be a very good definition, not only of coal, but of the whole vegetable kingdom. When they used coal, they used energy radiated from the sun in past ages of the earth. In "Gulliver's Travels," they were told of a Professor who had spent eight years in trying to extract sunbeams from cucumbers. It was nothing else, if they considered coal, as it really was of vegetable formation. When he had the honour of delivering his Presidential Address last year, he endeavoured to point out the honourable position which the gas industry occupied in this respect. They had, he contended, been able to supply many more sunbeams out of the cucumber than anybody else. In the report of the Royal Commission on Coal, the average steam consumption per brake horse power, of all steam plants, was given as 5 lbs.; and they in the gas industry could, by means of a gas-engine, give a brake horse power from 3½ lbs. of coal distilled in a retort, and they had left, in addition, the coke and other residuals. There was no motor of any kind, of 50 or 60 horse power, which was cheaper or more economical than the gas-engine; and in large establishments, where a considerable amount of current was required, certainly the electric light could be generated very much cheaper from ordinary gas and a gas-engine than by any other means. He heartily congratulated Mr. Simpson upon his most interesting paper.

Mr. S. B. LANGLANDS (Glasgow) said he had listened with great interest to the paper; but from figures before him, he doubted whether Great Britain was now the largest producer of coal. The question of the value of coal from the gas manufacturer's point of view was a very interesting, and sometimes a very serious, one. As to the deterioration of coal, he had known it lose 500 or 600 cubic feet of gas per ton when it had been lying for a month. Mr. Lowe mentioned the use of gas-engines for electric lighting. He might say that they had already quite a number of them in use in the city; and he hoped they would increase.

Mr. P. MACDOUGALL (Helensburgh) said he should much like Mr. Simpson to give them some information as to the spontaneous combustion of coal, which gas managers had occasionally to consider, and how to prevent it. Some time ago he heard of a coal mine taking fire, all attempts to extinguish which failed until a chemist pumped in carbon dioxide till all the air was expelled.

Mr. A. SMITH (Tradeston) would have been glad if Mr. Simpson had given them a little more information as to the different kinds of coal. Some of the younger members might wish to know the meaning of (say) ell or splint coal, and even the meaning of the word "cannel." However, Mr. Simpson had broached the subject to them in a very interesting manner. He agreed that a visit to a coal pit would be most instructive, especially to see the coal-cutting machines.

Mr. W. M. MASON (Glasgow) said it might interest the meeting to know that one of their contractors last year supplied, from one of their pits, coal which had been cut by machines; and they found that it was in such huge lumps—great square blocks—that it was impossible to handle it. It was too big to be handled even by the coal-breaker, and they had to stop it. In his opinion, the coal supply was the one subject which gas managers should think about, because if they could not get cheap coal, they could not supply cheap gas. He did not know that anything was said about the testing of coal; but in Glasgow they found that the principal check upon coal—the test which stood, and that which the coal people could not possibly get round—was the test of the chemist, showing the percentage of ash, and, in fact, the whole quality of the coal. He might say that the last visit which had been arranged for the session was to the Summerlee Iron and Steel Company's works at Coatbridge. The Company had several very large coal pits, and it was in the mind of the Council, when they arranged it, that if any of the members wished to go down a pit on that occasion, they might do so.

Mr. A. WILSON (Glasgow) wished to say how much they were

indebted to Mr. Simpson for bringing before them a subject which was so closely allied to the gas industry. A visit to a colliery would, he thought, be most interesting to all of them. A great deal of information could be obtained with reference to the various kinds of machinery used, and the way in which coal should be handled; and then, when the coal came in, they would be able to say whether or not it was in proper condition. He had himself been down a few coal pits for this very purpose. They were getting more particular about the kind of coal they used. They not only wished to make gas of good quality, but to have a good coke; and therefore they required a class of coal which gave them very little ash. They were not very happy in this respect in the West of Scotland; but, by dint of regular testing, they were able to eliminate the coals which were high in ash, and obtain those that gave them coke, which was becoming a most valuable product.

Mr. SIMPSON said he quite agreed with Mr. Lowe that it did not matter very much what the difference in the coal was, or whether they could give a definition of it. The great thing was to get coal as good as they could. He was positive that this country was still leading the way in the matter of the output of coal. Last year it was nearly 22½ per cent. of the whole world's output. He had never seen coal-cutting machines at work; but he understood that they were only applicable to thin seams. He had read of a pit in Lanarkshire where they had a machine which could produce as much coal as twelve men. As to the different classes of coal, he thought that to most of them they were so well known that it would have been superfluous to take up time by describing them. His paper had been a very small contribution to the Association, but he was pleased to think that it had given members some information; and he thanked them very much for the kind remarks they had made.

On the motion of the PRESIDENT, a vote of thanks was accorded to Mr. Simpson for his paper.

The next item on the *agenda* was a paper by Mr. T. M. MOIR (Perth), entitled

NOTES ON GAS-WORKS BOOK-KEEPING.

Mr. Moir was present, but, not being in very good health, his paper was read by the Secretary (Mr. G. Braidwood).

The author began by explaining that the object of his paper was to bring under the members' notice various points which had arisen during his experience in the keeping of the books of a gas-works. In the first place, the books should be so kept as to enable the manager to obtain at any time the correct cost and working results of the undertaking. The accounts of several gas companies were striking examples in this respect. He then proceeded to consider his subject in detail.

(1) *Fittings Stocks.*—It was necessary that the value of materials used should be carefully charged to the various departments; and for this purpose it was essential that a storekeeper be employed. Fitters required particular attention, as much work must necessarily be left to their discretion. The returns of the different foremen should be so arranged that they should furnish a record, in writing, of the actual work done by their various workmen.

(2) *Stocks of Sundry Tools.*—It was important that a strict check should be kept on sundry tools, loose plant, and the like; and in order that these things might not be lost sight of, they should appear in the stock at valuation and be charged to revenue.

(3) *Residuals, Secondary Products, and Fire-Clay Goods.*—It was assumed that these stocks were kept in such a way that no inaccuracies occurred. Bye-products used by the various departments should in all cases be weighed or measured, as in the case of private traders.

(4) *Books.*—The following books were necessary for the purchases made in ordinary gas-works: (*a*) Coal and enrichment materials invoice-book; (*b*) residuals and secondary products invoice-book; (*c*) repairs and maintenance of works invoice-book, including fire-clay goods, repairs, and sundries; (*d*) repairs and maintenance of mains and services invoice-book; (*e*) repairs and maintenance of stoves invoice-book; (*f*) repairs and maintenance of meters invoice-book; (*g*) stores, tools, and sundries invoice-book, including fittings—a fittings apportionment book would, of course, be kept for the purpose of charging fittings used to the various departments; (*h*) capital charges invoice-book. Each works would, of course, be affected by its own peculiar circumstances, and the books required were governed thereby.

(5) *Meters, Stoves, Mains and Services, and General Stores Stocks.*—All stores should be so arranged that the storekeeper would have no trouble in serving out materials and taking stock. No material should be given out without a written order on the storekeeper. Samples of goods should be kept to check bulk; and a complete price-list of all materials purchased should be made up, and the different makers' prices, from time to time, compared. With regard to meters and stoves, all new goods should be stamped with the stock number. For instance, during the year 1905, the first one entered as received during the year would be stamped 105 (the initial number), the second 205, the third 305, and so on; and when meters were handed to the gas-fitter, the date should be plainly marked, as 1/10/05, preferably on the back of the index-box lid.

(6) *Official Order and Invoice-Form.*—It was recommended that every company or corporation should, for ordering goods, have an official order form (the order itself to be in duplicate), and the particulars of the invoice to be filled in by the trader. It was, however, necessary for the tradesman to render his own statement of account with the form. Unless this was complied with, no account could be passed for payment.

(7) *Incandescent Fittings, &c.*—Where incandescent burners and accessories were purchased, it was advisable to open a separate account for this branch alone.

(8) *Fittings.*—Materials such as iron tubing and connections, lead, compo pipe, tin pipe, brass fittings, &c., should be charged to a suspense fittings account. This account could be apportioned against the various departments at the end of the year; and a fittings apportionment book kept.

(9) *New Mains and Services.*—A record of all materials used on new mains and services should be kept, so that everything originally paid through revenue could be credited back to revenue and charged to capital.

(10) *Expenses on Residuals (including Secondary Products).*—A separate book should be kept for this branch; and all items, such as carriage of coke for sale, acids, repairs, &c., entered (under the respective headings)—*e.g.*, coke, tar, pitch, oils, and sulphate of ammonia—should be entered in it.

(11) *Coal Accounts.*—After checking the coal accounts for payment, they should be entered as follows: Date; Name of trader; kind of coal; rate per ton; weight; amount of account; invoice number. By entering the accounts separately in this manner—the tonnage against the amount of the account—a record was kept throughout the year of the average price per ton of coal purchased; and this information was a great boon to every gas manager. A separate column could be spaced for oil and spirit bought; and this made the coal and enrichment purchases complete.

(12) *Repairs on Plant and Works.*—Some works charged all repairs direct to the "repairs and maintenance of works" account, whether in connection with residuals and bye-products or not; thereby working the residuals and bye-products business at a profit more apparent than real. Other works again charged themselves only with repairs to works and plant; whereas it was customary in Scotland to maintain as well as repair these plants out of revenue, thereby giving them a new lease of life. In this connection, it might be advisable, where there was a reserve fund for depreciation of works, that in the case of a large expenditure on (say) retort renewals in any year, to receive back from this account a certain payment—thus entailing no extra charge on the capital account.

(13) *Wages.*—The workmen's time-sheets should be strictly supervised, so that in working out the weekly sheets the foreman in charge could fill in the actual hours worked under each head. A wages apportionment book should be kept; showing a comparison with the same week of the previous year; and also the cost per 1000 cubic feet of gas made. The following was a list of the heads necessary.

Manufacturing Charges.—Coal: All labour in bringing the coal to the retorts. Carbonizing: Machine men, engine men, coal-wheeling, &c. Purifying: Cost of labour on purifiers. Repairs and Maintenance of Works: General repairs and maintenance, including retort repairs. Sunday duty: Allowances for extra work.

Expenses on Residuals, &c.—Coke loading (export) for sale, pitch, refined tar: All repairs and labour connected with sales. Other secondary products: All repairs on ammonia plant, and charges connected with sales.

Distribution.—Repair and maintenance of services: All work in this connection, whether repairs or fitting. Public lamps: Labour connected with fitting and repairing street-lamps. Inspection of consumers' fittings: All labour in house-to-house inspection and the fitting of burners. Repair and maintenance of meters: Cost of labour in repairing, fixing, and removing meters. Repair and maintenance of stoves: The same as meters. Fittings account: Storekeeper's time.

Capital.—Extensions: Labour in laying out new works, plant, &c., new mains and services. New meters: Fixing, time fixing, but not in the case of an exchange, which would be charged to revenue. New stoves: Fixing, do., do.

(14) *Inspection of Consumers' Fittings.*—Burners, &c., bought for free distribution in connection with the inspection of consumers' fittings should be charged direct to this account. This, in connection with the corresponding item in the wages account, would show at a glance the actual cost of working the branch.

(15) *Carbonizing-Book.*—This book should give at once the information required daily in the way of coal used, gas made, residuals and secondary products made, stocks, &c.; and also show comparisons with corresponding periods.

(16) *Goods Received and Dispatched.*—A journal should be kept showing the goods received daily, to check invoices; also all empties returned and goods dispatched and not charged for at the time.

(17) *Cartages.*—A cartage-book might be required. The items should be entered daily; and if the carting were done by contract, there would be a check on the account rendered.

(18) *Inventory.*—An inventory-book should be kept, giving a complete record and valuation of everything in the works.

The author concluded by saying it was impossible, in the limited space at his disposal, to enumerate all the books required for a

gas undertaking. The paper, therefore, only applied to the works, and not to the collection branch. He trusted the information given might be of interest to the majority of the members, and be the means of eliciting discussion on the system of gas-works book-keeping.

Discussion.

Mr. J. LOWE (Glasgow) said he was quite in accord with a great deal of what he had been able to take in of the paper. Accounts of new capital expenditure required to be kept very carefully and completely, as they served afterwards as a record of the cost of work. By keeping a correct statement of the cost of labour and material for each individual (say) retort-bench, well, roof, house, or whatever it was that was going on, they could train themselves to form an adequate conception of what future work would cost. Mr. Moir had touched upon the costs of the different processes—carbonizing, purifying, and so on; but there was considerable difference of opinion as to what should be included in these costs, and what should be left out. Until there was some agreement as to this, they could not have a comparable system of cost as between the different methods of carbonizing.

Mr. W. M. MASON (Glasgow) thought one point which was emphasized in the paper was that the common clerk was a factor in connection with gas-works that was sometimes overlooked. A poor clerk was nothing, because he was a clerk. This was a very common delusion; and he (Mr. Mason) would undertake to say that if they put a thoroughly qualified engineer to keep a set of gas-works books, he would make a worse job of it than a clerk would if he were set to design a gas-works.

Mr. J. MANN (Glasgow) said he expected to have some information in the paper as to the capital employed per ton of coal carbonized and per 1000 cubic feet, and other matters.

Mr. A. WILSON (Glasgow) thought the members were all indebted to Mr. Moir for bringing forward his paper, which dealt rather with the system of accounts. Mr. Mann wished to get information upon what might be called the politics of the finance of a gas undertaking. He (Mr. Wilson) counselled the members, whatever their position might be, to make notes of what they were doing. These might not be of immediate necessity, but they were sure to be of the utmost value afterwards. He had found this to be so in his own experience. He had notes which he took in connection with work at the time when he was serving his apprenticeship; and occasionally, even now, he turned them up, and found them most valuable. Book-keeping was, of course, not part of an engineer's duty. They were all required to make a complete whole in a gas-works. Even the common clerk was quite as necessary as was the engineer. In their own undertaking, the accounts of every station were compared as to their working each week in all the departments. The results came to the Engineer; and it was in the results that they found whether or not good work was being done.

Mr. MOIR said he had only dealt with methods of book-keeping; the actual working was a different thing. He did not mean to give a history of what could be done with the books, but only to enumerate the different books he thought were necessary.

The PRESIDENT called for a vote of thanks to Mr. Moir; and it was heartily accorded.

The proceedings then terminated.

Eastern District.

Last Saturday afternoon, the members of the Eastern District, to the number of about thirty, paid a visit to the Dunfermline Corporation Gas-Works. The weather was unfavourable, and, besides, it was Term Day in Scotland; both of which circumstances affected the attendance. Mr. J. Dickson, the President, is stationed at Dunfermline, and he met his visitors at the railway station. At the works they were received by Mr. A. Waddell, the Engineer and Manager, along with whom was Bailie Stewart, the Convener of the Gas Committee. Having assembled in the meter-house,

Bailie STEWART said that, as Convener of the Gas Committee of the Dunfermline Corporation, he had the greatest pleasure and satisfaction in inviting and welcoming the Association to see their works. Provost Macbeth had that forenoon asked him to convey to the members his thanks, because they liked to be in the position that the Association should take an interest in their works. They were at liberty to see everything they had which was worth looking at; and they could take away all the information they could get. The Gas Committee were very proud to think that Mr. Waddell had one in his employment who had been honoured in being made President of the Junior Gas Association. He hoped that Mr. Dickson would go on and qualify himself, and that some day the Association—of another generation—would visit large works of which he would be the Manager. He did not know that he could say anything about the equipment of their works in comparison with others. In Mr. Waddell they had an excellent Manager—one who was never done inventing something to save money to the ratepayers. He was glad to think that not only the Manager but the Gas Commissioners appreciated Mr. Dickson, for the interest he took in the working of the concern.

Mr. A. WADDELL intimated that it had been arranged that the visitors should go round the works in parties of six or seven; and he had appointed workmen to guide them.

This arrangement was carried out. As the outstanding feature of the works—the coal and coke handling plant—was described so recently as a month ago by the President (Mr. J. Dickson) in his Inaugural Address (see *ante*, p. 116), and more fully in the "JOURNAL" for Sept. 1, 1903, p. 557, it is unnecessary to further deal with them. The members were shown the process of bringing in the coal, storing it, taking it to the overhead hoppers, and removing the coke, storing it in the yard or immediately despatching it, by the conveying plant—being carried from floor to floor by the hydraulic lift. They also saw Mr. Waddell's regenerative settings at work, with his own method of quenching the coke, and also the West hand-charging machines in use.

Having gone round the rest of the works, the party repaired to Pittencrieff Glen, the handsome gift of Dr. Andrew Carnegie to the town; passing on the way the humble tenement in which he was born. At the *chalet* in the Glen, tea was served. At the close of the repast,

Mr. W. BROWN (Lasswade) moved a hearty vote of thanks to Mr. Waddell for his kindness to the members. He said the visit to the gas-works, so long looked forward to, was now an accomplished fact; and he thought he spoke for all when he said that they had thoroughly enjoyed themselves. The works which it had been their pleasure to visit were of the most modern description, well designed, and well organized. They, and the special appliances in them, were a tribute to Mr. Waddell's skill as an engineer; and the visitors would all go home with the feeling that they had spent a most instructive and profitable afternoon. In the vote which he proposed, he wished to include those members of Mr. Waddell's staff who had shown them over the works.

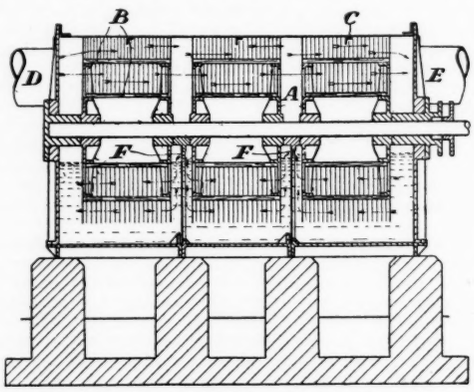
Mr. WADDELL returned thanks, and the party separated.

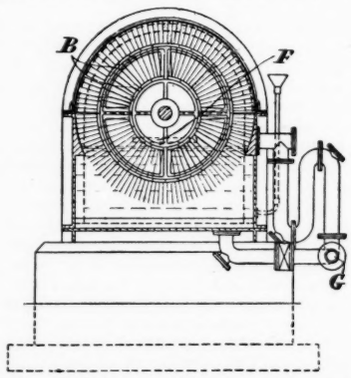
REGISTER OF PATENTS.

Rotary Washers or Scrubbers.—Creeke, R. W. B., of Leven, N.B. No. 27,820; Dec. 20, 1904.

This invention has for its object "to carry out the process of purification in a more efficient manner than has hitherto been effected by the elimination of ammonia from coal gas by bringing the gas into contact with water or weak ammoniacal liquor, which absorbs the ammonia."

The washer consists of a rectangular cast-iron casing and a circular wrought-iron or steel cover. Within the vessel is a horizontal central shaft (supported on bearings) carrying throughout its length a series of circular brushes, separated from one another. Each brush consists of two





end drum cheeks A and two concentric rings of staves B filled with bass fibre. The brushes are keyed on the shaft and rotated by it. The vessel is provided with division-plates extending across its breadth from the centre to the bottom, and so arranged that each brush section operates in a separate trough. Fixed to the circular cover, and midway between each end of the brush, is an angle-iron ring C for diverting the gas to the centre of the brush and preventing the channelling of the gas. At one end of the casing D is the inlet of the unpurified gas, and at the other end an opening E for the exit of the purified gas—the upper set of arrows indicating the direction of flow. In each lower division-plate between the brushes are long slots F cut at the proper level to allow the

liquor to overflow from one position to another, and in the opposite direction to the gas—as indicated by the lower set of arrows. Running parallel to the casing is a cast-iron pipe G, with branches and valves connecting to the bottom of each section, for the purpose of drawing off liquor or transferring it in bulk from one section to another.

The brushes are made to revolve in a bath of liquor so as to be kept thoroughly wet, and the gas, passing from the inlet to the outlet, must seek its way through the wet fibre of the brushes. In this manner the gas and the liquor come in contact with each other in a finely-divided state, and the liquor absorbs the ammonia "very efficiently." The liquor overflows through the apertures F in the opposite direction to that of the flow of the gas, with the consequence that the gas in its passage through the apparatus comes in contact with cleaner liquid in each successive section.

Treating Distillation Gases to Obtain Illuminating Gas in a Highly Compressed Form, suitable for Transport.—No. 23,675; Nov. 2, 1904. Date claimed under International Convention, Nov. 2, 1903. —Blau, H., of Augsburg, Germany.

In the course of his specification, the patentee remarks: Illuminating gas is usually conveyed from the gas-works "through a centralized network of pipes laid in an area wherein the individual consumers are congregated more or less densely, as in towns and cities." For conveyance in closed cylinders or vessels, illuminating gas (in view of its considerable volume) does not in normal circumstances lend itself. In cases where this is done—for example, for the purpose of lighting railway carriages—the gas is compressed under a pressure of from 8 to 12 atmospheres into iron cylinders, and supplied to the burners, as required through suitable pressure reducing mechanism. The attempts which have been made by compressing the gas under a pressure of (say) 100 or 150 atmospheres to attain a correspondingly higher concentration of illuminating gas, and thereby make its transport to great distances practicable, have hitherto been unsuccessful, on account of the fact that, by such compression, the homogeneity of the mixture of gases of which ordinary illuminating gas consists is lost, inasmuch as the hydrocarbons which are suspended in it in the form of vapour are condensed into a liquid, the quantity of which increases the higher the pressure is raised. Thereby at the same time the combustible and illuminating qualities of the gas are also correspondingly diminished; this, according to the researches made by Pintsch with reference to oil gas, amounting, at a pressure of only 10 atmospheres, to from 25 to 44 per cent. In carburetting apparatus, the combustible quality of the gas can, of course, be restored in a measure after its escape from the cylinder at the pressure at which it is to be used; but the employment of a process of this kind, it is asserted," leads to complications which render the advantages offered by a gaseous illuminant, owing to the simplicity and convenience in using it, more or less questionable."

The process which forms the subject-matter of the present invention —besides utilizing the capability of the gases to absorb a large quantity of the more volatile hydrocarbons in the form of vapour, and thus form therewith a homogenous gas-mixture—takes advantage also of a property of the oil of condensing on compression of the distillation gases. It has been established by experiments that at least those condensed hydrocarbons from distillation gases produced at very low temperatures have the power of absorbing under a higher pressure these distillation gases, with the exception of a certain excess—chiefly permanent constituents CH_4H_2—to such an extent that the quantity of gas dissolved or absorbed suffices, on escaping from the cylinder at the main pressure and the normal temperature, to change the heavy hydrocarbons (excepting a small residue of those most difficult to volatilize) into their gaseous form. In this, it must be observed, it is necessary that the mixture of liquified hydrocarbons be taken from the cylinder in the fluid condition under as near as possible constant pressure, and conducted through pressure-reducing devices, whereby the whole of the liquid again passes over into its gaseous state.

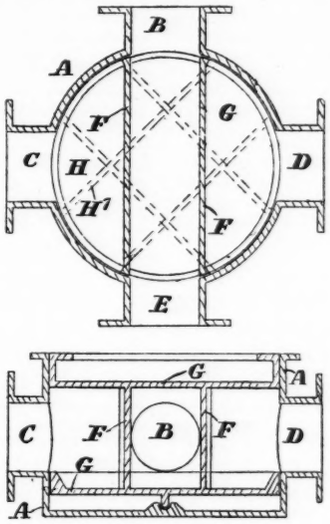
The products of distillation obtained at a very low temperature and freed—by cooling or washing with oil—from the constituents which are most difficult to volatilize, are in so far the most suitable for the purpose that they, on the one hand, contain a large proportion of fluid hydrocarbon compounds (C_4H_{10}, &c.) with a very low boiling point, which on condensation under the cooling action of water, and pressure, are capable of dissolving or absorbing a very large volume of gas, and, on the other hand, also contain a considerable proportion of the gaseous hydrocarbons which are most readily soluble in liquid hydrocarbons, so that the production of a mixture having the properties of an illuminating gas in a suitable form for transport is most easily accomplished from such distillation products.

Four-Way Gas-Valve for Reversible Condensers and other Gas-Plant.—Chandler, S. & J., and Solomons, J. H., of Victoria Street, Westminster. No. 3682; Feb. 22, 1905.

This invention consists in making a central gas-channel (instead of using within the body of the valve a single slender partition or plug) for "soundly shutting off the gas and bye-passing the apparatus, so as to cut off or leave the condenser under entire control for either cleaning purposes, or repairs, or other contingencies." The patentees say they are aware that Anderson's four-way valve, patented in 1856, would "accomplish the reversible action of the condenser, but without providing in one and the same body a channel devoted and only applicable to bye-passing the apparatus." The present invention "provides this very important omission, and accomplishes in one body a complete shut-off for either two or four gas-passages, and at the same time provides a bye-pass for the apparatus."

The body of the valve is of cast iron; and the connections are cast on it as shown at B, C, D, E. The top and bottom plates G of the plug have between them the cast partitions F, forming the channel for the bye-pass H, H_1. The dotted lines show the position of the channel when the gas is to be diverted through the apparatus to which it is connected.

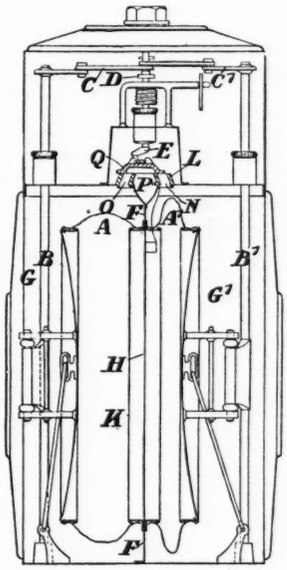
The valve (when in position) is linked up to the condenser or other apparatus by the connections C, D; and the connections B and E are made with the gas inlet and outlet mains. When it is required to completely shut off the condenser, the channel of the valve would occupy the position shown, and the gas would pass straight through the bye-pass; but by turning the plug so that the channel occupies the position



shown on either of the dotted lines H, H_1, the bye-pass would be cut off, and the gas would flow either to the right or left and through the condenser as the case may be. Thus, by alternately putting the channel in the positions shown by the dotted lines, the inlet and outlet would be reversed.

Dry Gas-Meters.—Alexander, W., of Edinburgh. No. 736; Jan. 14, 1905.

In meters where the flow of gas into and around the diaphragms or bellows causes them to move backward and forward (and this movement is conveyed through the usual flag-rods, top arms, and tangents, to give movement to a crank), the diaphragms or bellows are usually placed on each side of a division-plate, the patentee remarks, so that there are separate chambers on each side, each containing a diaphragm of bellows. In this arrangement of meter, a similar division-plate is employed, with a diaphragm or bellows on each side; but the division-plate is cut away between the inside of the two diaphragms or bellows, or the inner parts of the two are connected through a hole or opening in the division-plate so as to allow either or both diaphragms or bellows to be filled or emptied at one time, or the port or opening to the inside of each diaphragm or bellows may be separately connected by passages to the valve. The meter has thus a common chamber bounded by the two diaphragms or bellows and two outer chambers, one on each side.



A and A^1 are the diaphragms or bellows, which by the flow of the gas move backward and forward. This movement is conveyed through the usual flag-rods B and B^1, top arms C and C^1, and tangent D, giving movement to the crank E. The diaphragms or bellows are placed on each side of the division-plate F, so that there are separate chambers G and G^1 on each side containing a diaphragm or bellows. The division-plate is cut away between the inside of the two diaphragms so as to form the hole H, allowing either or both the diaphragms or bellows to be filled or emptied at one time.

The gas, entering at the usual inlet, passes through the ports or openings N and O leading to the outside of the compartments G^1 and G; thus pressing the diaphragms or bellows A and A^1 inwards and forcing the gas from the inside of the diaphragms or bellows or compartment K, through the outlet or exhaust-port or opening P. By this movement the crank E is revolved, and the valve cover Q drawn over the port or opening N, leading to the outside of the diaphragm or bellows A^1 on one side or compartment G^1—thus shutting it off. The gas is now filling the compartment G, exhausting from the compartment K; and the compartment G^1 is shut off. The further movement of the crank draws the valve cover over and shuts off the port or opening M leading to the compartment K, and at the same time it opens the compartment G^1 to the outlet or exhaust P, and the compartment G is still filling. By this movement, and as the crank is turned further round, the valve cover shuts off the compartment G and opens the compartment K. Gas is now filling the compartment K, exhausting from the compartment G^1, and the compartment G is shut off. The crank has

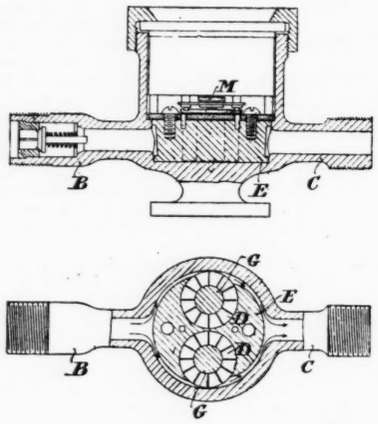
now made half-a-turn, and has drawn the valve cover over the full length of the stroke, and the gas is filling compartment K, and exhausting from G^1 and G compartments.

The further revolution of the crank or return stroke of the valve cover is as follows: The crank being revolved further round draws the valve cover over and shuts off the compartment G^1. By this action, the gas is filling the compartment K, exhausting from the compartment G, and the compartment G^1 is shut off. The crank being revolved still further, the valve cover Q shuts off the compartment K. This movement opens (for filling) the compartment G^1, the compartment G is open to the outlet or exhaust P, and the compartment K is shut. The further revolution of the valve cover shuts off the compartment G and opens the compartment K to the outlet or exhaust P, while compartment G^1 is filling. The crank E now brings the valve cover to the end of the return stroke, or its original position. The gas is now filling compartments G^1 and G, and exhausting compartment K—making one complete cycle or rotation of the crank E and other mechanism.

Water-Meters.—Lezgus, L., of Hagen-in-Westfalen, Germany. No. 5875; March 20, 1905. Date claimed under International Convention, April 19, 1904.

This invention relates to a water-meter having a divided passage for the water and two paddle-wheels coupled together. Concerning this type of meter, the patentee remarks: Well-known water-meters have the drawback that, when the supply cock is open only to a slight extent—that is to say, when the pressure is only small, and the speed of flow also small—they give false indications. This fault goes so far that the meters sometimes stand quite still, while there is water flowing through them. In some constructions, this is due to the fact that the paddle-wheels have too much play in the casing or are arranged too far away from the water inlet, and the water is thus deviated too much from the direction it had at its admission. In other constructions (in which a closed casing is employed), the paddle-wheels are without a canal for a distance greater than half the circumference—this being necessary on account of the filling and draining of the chambers. It happens then that two adjoining chambers are filled simultaneously, and the paddle-wheel is caused to rotate backwards, as, owing to the missing resistance of the measuring apparatus, it runs easier.

In the meter constructed according to this invention, there is no filling of paddle-wheel chambers; water being supplied by two canals of rectangular cross-section to two paddle-wheels positively connected together in which, at the outside, only a quarter of the circumference is lying free, and the jets of water strike the vanes at right angles. As definite quantities of water correspond to definite speeds of flow, the quantities of water rotating the paddle-wheels always with definite speeds, the measurement takes place without the filling of the chambers between the vanes, by the number of the revolutions of the wheels. In dividing the water admitted, there is also the advantage that shocks taking place in the water-pipe are considerably reduced by the sudden



change of direction before admission, and by the great friction in the flat admission canals to the paddle-wheels, so that they exercise only a small influence on the paddle-wheels.

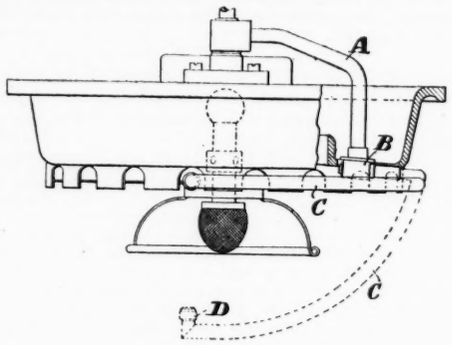
The casing shown has an inlet branch B and an outlet branch C, between which is secured an insertion E, having in it two round holes D. The insertion is provided at its circumference with a circular groove F, which, together with the wall of the casing, forms rectangular canals for the admission and discharge of water. In the holes are arranged paddle-wheels G, the vanes of which are struck by the water-jets. The wheels are mounted on spindles supported at the bottom in the casing and at the top in a covering plate screwed on the insertion. To the upwardly extending portions of the spindles of the wheels are secured toothed wheels of equal size, which engage with each other; so that both wheels G must always rotate simultaneously and at the same speed. To one of the toothed wheels there is connected a smaller wheel engaging with the wheel M mounted on the driving spindle of the registering apparatus in the upper portion of the casing.

On entering, the water is divided into two separately flowing currents and flows (in the direction of the arrows) direct against the vanes of the paddle-wheels G, whereby they are turned without the chambers being filled with water. The currents of water escape on the other side of the paddle-wheels, and again join together in the discharge branch C. The rotating motion of the paddle-wheels is transmitted by means of the toothed wheels to the driving-wheel of the registering apparatus.

Inverted Incandescent Gas-Lamps.—Bousfield, J. E. A communication from Julius Pintsch, of Berlin. No. 6666; March 29, 1905.

This invention relates to inverted gas-lamps—chiefly designed for illuminating railway cars—and it consists in providing such lamps with an "emergency gas-arm" carrying a burner which can be lighted in case the main burner fails.

On the frame or crown-plate carrying the lamp, the bunsen burner for the inverted lamp is mounted in the usual manner, and supplied with gas through the pipe at the top. A branch-pipe A extends from it to a housing B mounted in the frame of the lamp; and in this housing is



pivoted the end of a pipe C—the axis of the pivot being radially disposed as regards the axis of the lamp, and the pipe itself being curved to an arc having substantially the same radius as the lower rim of the frame or crown-plate. Thus when the arm is turned up, it will lie against the crown-plate, as shown in dotted lines, and "will not in any way spoil or disfigure the appearance of the lamp." The free end of the arm is provided with an ordinary gas-burner D. Should the incandescent gas-lamp fail or become defective, it is simply necessary to turn down the arm C into the position shown in dotted lines, then cut off the gas feed to the bunsen burner by closing the ordinary gas-tap, and turn on the tap of the arm C (not shown) and light the burner D. Thus the incandescent lamp is replaced by the emergency burner.

APPLICATIONS FOR LETTERS PATENT.

21,510.—Cobham, E. C., and Pavis, J. P., "Train lighting." Oct. 23.
21,524.—Makin, J. H., "Lighting lamps." Oct. 23.
21,531.—Clayton, R., and Hawthorn, H. S., "Controlling the supply of gas to burners." Oct. 23.
21,559.—Weeks, J. W., "Gas-regulators." Oct. 23.
21,566.—Reichenbach, F., "Gas-engines." Oct. 23.
21,572.—Jones, H., "Water-main valves." Oct. 24.
21,606.—Robertson, T. W., "Securing inverted burners." Oct. 24.
21,625.—Honig, A., "Meters." Oct. 24.
21,715.—Williams, A. A. V., "Generation of combustible gases." Oct. 25.
21,716.—Curtis, J. C. R., "Incandescent gas-lamps." Oct. 25.
21,728.—Davis, A. S., "Gas-fittings." Oct. 25.
21,732.—Mason's Gas Power Company, Ltd., Bentley, G. H., Wright, T., and Hollis, A., "Gas-producers." Oct. 25.
21,765.—Thorp, T., "Anti-pulsators." Oct. 26.
21,775.—Stobie, V., "Regenerative gas-furnaces." Oct. 26.
21,776.—Rose, A., and Bellamy, W., "Incandescent burners." Oct. 26.
21,828.—Kent, T. F., "Incandescent burners." Oct. 26.
21,872.—Stokes, J. W. B., "Gas-calorimeter." Oct. 27.
21,874.—Lund, B., "Anti-vibrator." Oct. 27.
21,880.—M'Lean, J., Harrold, G. H., and Carey, T., "Acetylene-generator." Oct. 27.
21,893.—Clama, A., "Incandescent burners." Oct. 27.
21,895.—Warry, J., and Arculus, G. N. & E. A., "Incandescent burners." Oct. 27.
21,961.—Buchanan, J., "High-pressure joint." Oct. 28.
21,965.—Rowbotham, W., "Power generators." Oct. 28.
21,970.—Olver, E. T., "Blending and combustion of coal or other gases and atmospheric air, with application for heating, lighting, and motor purposes, including facilities for consumption therein of other fuels for domestic or the like requirements." Oct. 28.
22,046.—Cleland's Graving Dock and Slipway Company, Ltd., and Roxburgh, A. B., "Gas-producers." Oct 30.
22,138.—Perry, R. G., and Richardson, A., "Gas-burners." Oct. 31.
22,228.—Nightingale, V. C. J., "Controllers for use in connection with the ignition and extinction of gas-burners." Oct. 31.
22,295.—Gourlay, W., "Mantles." Nov. 1.
22,330.—Eastman, A. L., "Acetylene generators." Nov. 1.
22,370.—Julian, E. H., "Gas-turbine." Nov. 2.
22,373.—Sutcliffe, H., "Supports for burners." Nov. 2.
22,382.—Bowmer, J. J., "Suction producers." Nov. 2.
22,393.—Marshall, A. H., "Gas-pendants." Nov. 2.
22,424.—Fitton, C. E., "Burning gas." Nov. 2.
22,512.—Newton, H., "Production and purification of gases." Nov. 3.
22,539.—Thiem, W., "Gas-heated tools." Nov. 3.
22,559.—Gourlay, W., "Mantles." Nov. 4.
22,563.—Clegg, J., "Incandescent fittings." Nov. 4.
22,565.—Wilkinson, J., "Producing and utilizing mixtures of coal gas and air." Nov. 4.
22,572.—Drabble, F. H. & H., "Gas-stove." Nov. 4.
22,594.—Capitaine, E., "Marine gas-engines." Nov. 4.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Inverted Gas-Burners.

SIR,—Being in the habit of going right through the "JOURNAL," I could not very well miss Mr. George Helps's reference to my view about the inverted burner.

If Mr. Helps prefers dark ceilings, I do not. If Mr. Helps's idea of light is semi-darkness, this is not my idea. If a darkened ceiling is the ideal, the mere covering of the globe with a shade—and this article, if one so wishes, can be had in the most exquisite taste to make a telling kind of decoration in the room—will effect it. The light collected and thrown in a downward direction from the inside of the shade is of a pleasing quality; and there is in it that agreeable radiancy peculiar to the upright burner. By a suitable, reflecting shade—whether of glass, metal, or cardboard—one obtains by far the best inverted light. It is just the natural way.

Mr. Helps seems to be concerned that I might walk on the ceiling. No, I do not; nor do I walk on my head. I am at a loss to understand why he should think I might. He must have missed the point in my observations about the inverted burner. The unnaturalness of the thing is against it. Walking on the ceiling is unnatural, is it not? This fact does not require labouring. Why then does Mr. Helps attribute to me such illogical possibility?

I cannot tell how many inverted burners I have seen, handled, and tested—there are so many of these freaks. The first I handled was offered to me about four to five years ago—that is about the time—by someone from Vienna. The opinion I formed then, I have not since changed. I admit that I missed a chance of making money; but that is not the question here. Perhaps Mr. Helps has an inverted burner which is different to others. I should really thank him, if in that case he would let me see it. I am open to learn.

There are people, and they count by many, who say that taking to incandescent gas lighting after the electric light is reversing the order of things in the path of progress. Under the natural conditions of incandescent gas lighting of to-day, they have surely proofs to the contrary. If they replace the electric by the inverted gas-lamp, I should say emphatically, it was going backwards.

C. J. ALEXANDER.

Wilson Street, E.C., Nov. 8, 1905.

Gas-Heating Appliances.

SIR,—We were glad to read the article in your issue of the 7th inst., regarding the experiments by a firm of stove makers with gas-fires, with a view to regulating the air and gas supplies and modifying the interior arrangements so as to obtain a maximum of effective heating result from the gas consumed. This matter especially commends itself to us, because we have, as it happens, been working for the past eighteen months in very much the same direction as that followed by our friends, Messrs. Wilsons and Mathiesons; and it has occurred to us that a brief record of our investigations might interest such of your readers as are concerned (and who of them is not?) with all questions affecting economical and effective gas heating.

Recognizing that the old iron-fret gas-fire probably largely owed the popularity it so long enjoyed to the fact that so small a body of material heated up very quickly, we naturally turned our first experiments towards effecting a combination of the undoubted advantages of the modern fire-clay "fuels" now in use with this excellent feature of the older arrangement. Having these points in view, we made a type of gas-fire in which we dispensed with all but the front layer of loose "fuel." By this means, we obtained a fire with an appearance of great brightness, while at the same time considerably reducing the gas consumption. A number of our fires of this type have been doing well in use for the best part of a year. We had in view, however, the scientific axiom—too often lost sight of in designing and testing of gas-heating apparatus—that, for heating a given space, a certain minimum quantity of fuel is indispensable; so that to suppose a fire effects a real saving because its bright appearance is maintained while the gas consumption is reduced, may be altogether illusive if this should be found to involve any considerable sacrifice of heating power.

At this point naturally arises the question of controlling the conditions of combustion; and this brings us to what we regard as a much more important aspect of the question. Many attempts have been made in the trade to attain this object by devices for adjusting the admission of air to the burner; and for several seasons we have been sending out fires fitted with a contrivance of this kind. Our experience, however, showed us that this method did not get to the root of the matter, as conditions affecting the air are obviously subject to much less fluctuations than those which affect the gas supply. Our next effort, therefore, was to couple with the adjustment of the air supply a corresponding regulation of the gas. It was found that while this worked admirably with small appliances like lighting burners, with larger apparatus, such as gas-fires—where complications arise in a more marked degree through differing conditions as to pressure, admixture of water gas, &c.—a double adjustment, while excellent in skilled hands, was bound to be unsuitable for handling by ordinary workmen. We were, therefore, led to the conclusion that, whatever the theoretical advantage of controlling both air and gas admissions, the most effective practical method was to concentrate our efforts upon producing a perfected adjustment for gas only, which should be independent of any necessity for air control, working in conjunction, and which should be specially designed for use, with gas-fires rather than for lighting purposes.

We, therefore, designed and patented several months ago a device of this kind which our tests since have shown to amply fulfil the conditions indicated, and which we are in the course of introducing through the ordinary channels. Having regard to the stocks which gas companies would naturally hold at the beginning of the season, we delayed putting this forward until they should have had an opportunity of reducing these; and it is interesting that two efforts should be launched at the same time in a direction in which we are disposed to look for important developments in gas heating.

JOHN WRIGHT AND CO., LIMITED.

Birmingham, Nov. 10, 1905.

Differential v. Flat Rates for Gas.

A Dutch correspondent writes: "Condensing gas-stoves for prepayment meters mean an increase in consumption in the winter, which causes a still greater difference in day consumption in that season as compared with summer. Is it not a commercial mistake to have a reduced charge for gas used for stoves? A lower price for cooking-stoves may increase the summer consumption, and prove profitable; but in winter I prefer a uniform price for all gas, whether used for lighting or for heating purposes. It seems to me it might prove more profitable to the gas companies to promote the use of coke for heating the houses in winter than reducing the price of gas for stoves."

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Tuesday, Nov. 7.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* ROMER *and* MATHEW.)

Spacey v. Dowlais Gas and Coke Company, Limited—The Workmen's Compensation Act.

This was an appeal by the defendants from the decision of the County Court Judge at Merthyr Tydfil, awarding the plaintiff damages, under the Workmen's Compensation Act, 1897; and it raised the question whether the employment on which he was engaged at the time he met with the accident, which resulted in the loss of an eye, brought him within the provisions of the Act. Plaintiff was engaged in cutting a trench in which a new main had to be laid about a quarter-of-a-mile from the gas-works when the accident occurred; and the County Court Judge, considering he was bound by some observations which had fallen from the Court of Appeal in the case of *Fenn v. Miller*, decided that he was employed "about" a factory, and awarded him compensation.

Mr. PARSONS, for the appellants, contended that the Judge had misdirected himself in law, and that to uphold the decision would be tantamount to saying that the man who lit the street-lamps, or attended to an incandescent mantle in the house of a consumer, was employed "about a factory."

Mr. T. BIGHAM, for the plaintiff, argued that in the case of gas companies the distribution and manufacture of the gas were quite inseparable; the system of mains being an integral part of the factory.

The MASTER OF THE ROLLS said the case clearly fell outside the meaning of "on" or "about;" and the County Court Judge, in arriving at the conclusion that the man was employed on or about the factory at the time of the accident, mistook or misapplied what had been said in that Court with reference to the meaning of the word "about."

Lord Justice ROMER said a workman could not be brought within the Act by reason of the mains being in physical proximity to the gas-factory at the time of the accident. The pipes formed no part of the factory; they were merely connected with the supply, and not with the factory. The supply was perfectly distinct from the manufacture; and gas-factories did not come within the Act because they manufactured gas, but only because they manufactured gas by means of machinery. The pipes had nothing to do with any special machinery; and it could not be said that they constituted the factory or formed part of the factory for the manufacture of gas.

Lord Justice MATHEW concurred.

The appeal was accordingly allowed, with costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Nov. 8.

(*Before Mr. Justice* WARRINGTON.)

Ingleton Electric Lighting and Power Company, Limited, v. Ingleton Gas Company, Limited—Damage to an Electric Cable.

In their statement of claim, the plaintiffs said they held statutory powers, under a Private Act obtained in 1903, to supply light and power to the parishes of Ingleton and Thornton-in-Lonsdale, in the rural district of Settle, Yorkshire. The defendant Company was registered in May, 1899, to take over the business of the Ingleton Gas Company, and had no statutory powers whatever. During the first week in January last, they dug a trench in a street in Ingleton, and while so doing seriously injured a cable belonging to plaintiffs; the consequence being that their customers were deprived of their usual supply of light and power for a day and a night. In the same trench, the defendants had laid a gas-pipe above the plaintiffs' cable, thereby preventing them from having free access to it. Defendants were frequently opening the roads where the plaintiffs' cables and lines were laid, and by so doing were liable to cause injury to them. Plaintiffs claimed damages and an injunction to restrain the defendants from laying their pipes within 3 feet of the cables and lines of the plaintiffs; or so as to interfere with free access to them, to require them to give three days' notice to the plaintiffs of their intention to lay pipes, and

to allow the work to be done under the superintendence of plaintiffs' officers.

Mr. MACMORRAN, K.C., and Mr. PARKYN appeared for the plaintiffs; Mr. NORTON, K.C., and Mr. M'SWINNEY represented the defendant Gas Company.

Mr. MACMORRAN said the plaintiffs claimed damages and an injunction for injuries done to one of the electric cables by defendants' servants in laying or relaying certain gas-mains. The plaintiffs were authorized by Provisional Order to supply electric light and power to the district of Ingleton, and therefore had statutory powers to put down mains and cables, subject to the supervision of the Board of Trade; and this they had done. The defendants had no statutory powers at all to open streets and lay mains, but they nevertheless did so; and in the course of some of these works last January, they so injured one of the cables that the village of Ingleton was thrown into darkness for one night, and the supply of electric power was very seriously interfered with for some time. The actual fault was only discovered after great expense and with some difficulty. There was no doubt that the damage was done to plaintiffs' cable by the negligence of the defendants' servants. He should have to submit, first, that they had been guilty of negligence; secondly, that the opening of the streets by them was unlawful, and that therefore they were responsible to the plaintiffs for the damage done; and, lastly, that this was not an isolated act, but one which had occurred in the past at intervals, and would consequently occur again. He therefore submitted that, under these circumstances, plaintiffs were entitled to the injunction asked for.

Mr. *D. Tattersall*, the Resident Engineer of the plaintiff Company, said he saw the defendants' men opening the streets in the first week in January last. Afterwards a "fault" in the cable was found which was only detected with great difficulty. [The injured cable was produced and inspected by his Lordship and Counsel.] Witness explained the fact that there was no immediate interruption of the supply by the assumption that a pick pierced the sheath of the cable, and probably touched the neutral conductor. If it had gone a little farther, and had touched either the positive or the negative conductor, it would have burned out at once, and the light would have gone out that day. But by touching the neutral conductor a hole was made in the cable which admitted moisture; and consequently a gradual leakage took place, which increased till it burned out altogether.

In cross-examination by Mr. NORTON, witness said the damaged cable was removed, and the cable on either side tested and found to be all right. He had seen the defendants' men working in the streets, and he came to the conclusion that the hole they made must have been in the same place as the cable. He admitted that the Gas Company was a very serious competitor with the Electric Light Company. The only damaged piece of the cable was that which had been taken out; but 30 yards were put in, as it was more convenient.

Thursday, Nov. 9.

On the resumption of the hearing to-day,

Mr. *Tattersall* was further cross-examined by Mr. NORTON. He said he saw the hole or trench made by the Gas Company's men on the 9th of January. One side was square while on the other it bulged. The bulge was on the road side, and not on the house side, of the thoroughfare; and he did not agree that, as Mr. Norton suggested, the even side of the trench was on the opposite side. He saw the men fill the trench up three times in the evening and open it again in the morning—at least, he saw them working at it in the morning; so they must have opened it. The level of the cable was about 4 inches below the gas-pipe. Witness was not present when the "fault" was discovered, but was there soon afterwards. He did not see Mr. John Slinger measure the distance between the cable and the pipes. Witness denied that it was 2 ft. 9 in. from the pipe to the cable. He had had some experience in laying cables, and he said it was not usual to lay a board on top of them, though he had heard of it being done; the object being to give warning to men digging that they were coming to a cable. He saw the cable in question put down. It was laid from a big drum, but without an inner reel, which was used in modern cables. He denied, however, that a "kink" was caused in the cable by straining, by which moisture might enter and eventually cause a short-circuit. He also denied that if, in seeking for the "fault," they put on full power, it would make a small hole bigger.

Re-examined by Mr. MACMORRAN: He was sure the current he put on the cable to find the "fault" could not have made the hole in it which was found.

Edward Tomlinson, a stonemason, formerly in the defendants' employ, described the digging of the trench by their men, when the 1-inch gas-pipe was taken out and the 2-inch pipe put in. The hole was opened every morning, and the pipes cut off, and the work gone on with; and at night they were reconnected and the holes covered over. He was employed by the Electric Lighting Company in February to reopen the hole; and when he got near the cable, he found the earth round it black, showing that the cable had been fused, and the sheathing was burned. [Photographs showing the damage done were here produced.] He saw Mr. Slinger there when the "fault" was discovered; and he said: "That's a pick mark."

Cross-examined by Mr. NORTON: The hole he opened was about 3 ft. by 2 ft. 9 in., and the "fault" was near the north end of the hole. The ground was loose; but they had to use a pick. He saw Slinger, but did not see a man named Berry. Just as they were finishing the work for the Gas Company, he was told by Mr. Wright to be careful not to interfere with the cables; but he denied that anyone before that told the men this. They could then see the cables in the hole.

Mr. *W. M. Harris*, employed by Messrs. Gilkes and Co., the Consulting Engineers to the plaintiff Company, said the work of laying the cables was done under his supervision. There were two cables—a feeder and a distributor—and they were laid on the east side of the road, as the houses supplied were all on that side. He was consulted on Friday, Feb. 3, with respect to a "fault" which existed in the cable; but before he arrived on the spot the plaintiffs' Engineer had located it. The feeder on which it existed was then left out in supplying light and power; and the result was that there was a great drop in the voltage in one part of the village, and a consequent loss of remuneration. The cable was cut in several places before they could get to the "fault," and it was found in perfect condition. Speaking as an expert, he should say there was very little doubt that the hole in the cable was made by a pick with a nearly square head. The curve in the steel armouring was all evidence that it was done in this way. Witness then explained how, if a hole was made in a cable in such a manner, the result would be that the current would be interrupted.

Cross-examined: The position of the cables was settled by the Secretary of the Company, and was afterwards approved by the Board of Trade. It was more convenient to put the cables at the side of the road near the houses. It was not usual, in the case of armoured cables, to lay boards on them; but he had known it done, though he did not say it was a reasonable and proper precaution. It was three weeks from the time the gas-main was put in to the time when the current stopped. How soon an accident like this would result in stoppage would depend on the season and on how long the wet was in getting in.

Mr. *W. F. Price*, a consulting engineer, said he went with the last witness to try to locate the "fault," and discovered it after several attempts. After such an injury as that in question, it would depend entirely on the condition of the earth, and how fast the moisture penetrated, as to when the cable would break down. It would be a gradual process. The damage in this case was undoubtedly done by the entry of a sharp instrument from the outside.

Cross-examined: The injury might have been caused some months before, but not in such soil as that in question. He had laid a good many cables, and had never been asked to place boards above them. He had seen cable armour pierced by a pick before.

This concluded the plaintiffs' case.

Mr. *Barlow*, foreman of the defendants' workmen, said he was told to make the excavation in question. The trench was only from 1 ft. 6 in. to 2 feet in size. When ordered to make excavations in the road, he was always told to be careful of the electric cables. They only went far enough below the 1-inch pipe to put in the 2-inch.

Cross-examined by Mr. MACMORRAN: The 2-inch pipe was laid for about 315 yards—nearly up to the corner of the road. He was told by Mr. Wright, both on the Saturday and on the Monday, when they commenced work to be careful of the cables.

Mr. MACMORRAN: Can you say whether or not the cables were actually exposed in the trench where you were working?

Witness: I am sure the cables were not exposed at all; I never saw them.

How do you know you did not touch them with your pick, if you did not see them?—I am sure I did not touch them.

Re-examined: He should have known immediately he touched a cable.

Mr. *Musgrove*, a plumber employed by the defendants to substitute the 2-inch for the 1-inch pipe, said he found the ground opened when he got to the spot; but he saw no sign at all of the cables. He was bound to have seen them, if they had been there. He saw the cable exposed at another place; but that was 35 yards away.

Cross-examined: He considered a trench 2 ft. by 3 ft. quite large enough to lay a 2-inch main.

Mr. *Berry*, an excavator, was also examined, and gave similar evidence to the last witness. He said he was present when the "fault" was discovered; and, at Mr. Slinger's request, he measured the distance between the gas-pipe and the cable, and it was more than 2 feet. A 2-foot rule would not nearly join the two pipes.

Mr. *John Slinger*, a Director of the defendant Company, said he saw the trench opened on the 7th of February, when the "fault" was discovered. The trench was about 3 feet wide; and when it was opened he asked Berry, the last witness, to measure it. It was 2 ft. 9 in. at one place and 2 ft. 7 in. at another.

Cross-examined by Mr. MACMORRAN: He denied that his men had done the damage with a pick, and also that he said, when he saw the mark on the cable, "That's the mark of a pick." He asserted that he never said anything of the kind.

Mr. *D. Waley* said he examined the distance between the gas-pipe and the cable, and found it 2 ft. 9 in.

Mr. *Luke Bell*, Highway Surveyor to the Settle Rural District Council, said the Gas Company applied to the Council for leave to open the road. They replied that they had no power to grant the permission; but, as the highway authority they would raise no objection to the Company doing it, if the road was properly restored. He had no reason to complain to the Council of the way in which the work was done, and no complaint was made.

Mr. *M. A. Adam*, B.Sc., consulting electrical engineer, said he had seen the cable, and he agreed that the hole had been made from the outside. The cable was not laid in any conduit; and he thought it would only be a reasonable and wise precaution to take that boards should be put over it. This was a common practice, though not universal; and he had known it done even where the cables were put in wood conduits. He agreed with the other experts as to the uncertainty which existed as to the time when stoppage would occur after damage, as it depended on a variety of circumstances.

Cross-examined: He would always put boards on any cables he laid.

Mr. *Brotherton*, another expert, said he quite agreed with the last witness as to the necessity for laying protecting boards on the cables as a safeguard against accidents.

Mr. *E. Wright*, the Secretary of defendant Company, said he saw the trench made by the men when they laid the pipes. The man who excavated did not make a lot of trial holes. He got right down on the pipe at once. He always told the men to be careful to avoid the cables; and they did their work well.

Friday, Nov. 10.

Mr. MACMORRAN this morning summed up the case for the plaintiffs. He said the first point on which he wished to lay stress was that the "fault" in the cable existed on the 2nd of February, and it was admitted it was caused by something which was outside. It was also proved that the ground had not been disturbed till it was opened for the

purpose of laying the gas-pipes, and there was no other pick or instrument used except that of the defendant Company. He said that no reasonable conclusion could be drawn from these facts except that the injury was caused by a pick, and must have occurred during the process of excavation by defendants' men.

Justice WARRINGTON: If I am to believe—and I do believe, on the actual circumstances of the case—the evidence of the defendants' witnesses, I do not see how their pick could have done it. The mystery seems insoluble.

Mr. MACMORRAN said his submission was this: They were dealing with an injury which was assumed to have been committed with a pick. Only one pick had been there—that of the defendants; and therefore the conclusion was irresistible that it must have been their pick which caused the damage. No doubt the cables were close to the point of excavation; so that in regard to distance, they were reduced to a matter of inches. If his Lordship accepted all that the defendants' witnesses said, he could still hold that they did the injury, but might have done it inadvertently.

Justice WARRINGTON, in giving judgment, said in this case the plaintiffs complained that the defendants had caused injury to one of their cables, which injury, it was admitted, was caused by a blow from outside, and was of such a nature that it might have been inflicted by a pick. The onus, of course, was on the plaintiffs to show that the injury was caused by the defendants' men. The defendants were a Gas Company, and it was said that the injury was inflicted by their servants in the course of some of their operations. With regard to the evidence, he would only remark as to the actual facts—that was to say, the circumstances surrounding the position of the cables and the pipes, and what was done by the Gas Company—that he preferred the evidence of the defendants' witnesses to that given for the plaintiffs. But in saying this, he did not desire in the least to reflect on the plaintiffs' witnesses, in the sense of supposing they were not telling the truth. But the defendants' witnesses gave their evidence very well. They were the people who did the work; and, in his judgment, they were more to be trusted, in regard to what was actually done, than the witnesses for the plaintiffs. The *locus in quo* was a street in Ingleton running roughly from north to south; and along the eastern side there were two cables belonging to the plaintiffs. The injury was done to one of these cables—the feeder, as was afterwards found out. In 1904, the Gas Company decided to change the pipes from 1-inch to 2-inch; and on the 9th of January last the defendants' men opened the road with the object of making this change. It came out in examination that the pipe was not quite in the middle of the trench; and if this was so, the side of the trench was some 14 inches from the cable in question. This cable, no doubt, was injured, though the injury did not make itself known till February, when the light failed. After considerable difficulty in localizing the "fault," it was discovered; and he thought he was safe in saying that the theory of the plaintiffs was inconsistent with the injury having been occasioned to the cable on the 9th of January. On these facts, the plaintiffs had not, in his opinion, discharged the onus which was on them, of establishing that the injury was occasioned by the defendants' workmen. But he went rather further, and said that, if he was to accept the description of what was done by the defendants' men, he must come to the conclusion that the injury was not caused by them. The strength of the plaintiffs' case was that in the cable there was a hole, admittedly made externally, which might have been caused by such an instrument as a pick; and that no explanation was offered as to how the injury could have been caused. The answer to this seemed to be that the plaintiffs had to satisfy the Court that the injury was caused by the defendants; and it was not for the latter to find an explanation of how it was done. Under these circumstances, and believing the defendants' witnesses, he must come to the conclusion that the facts as proved were inconsistent with the idea that the injury was caused by the defendants. He therefore found that the plaintiffs had not established their case, and the action would fail. Judgment would be for the defendants with costs.

Costs in Patent Actions.

In the Chancery Division of the High Court of Justice last Wednesday, Mr. Justice Buckley had before him the case of the *New Inverted Incandescent Gas-Lamp Company, Limited, v. General Incandescent Company, Limited*. It was a summons on behalf of the defendants, raising an important question of practice in regard to costs in patent actions. On Dec. 6, 1904, the plaintiffs issued their writ seeking to restrain infringement of their patent. On Jan. 25 last, the statement of claim and particulars of breaches were delivered; and on April 20 the defence and particulars of objections were sent. On June 2, the plaintiffs gave notice to discontinue. The defendants now asked for an order that the action should stand dismissed for want of prosecution, and that the costs of the particulars of objections should be taxed as though they had been certified as reasonable and proper; or, in the alternative, that the costs should be allowed as though certified as reasonable and proper. It was admitted that the first part of the summons was covered by authority, and could not be asked for. The application was therefore confined to the alternative relief; and it was argued that as the pleadings had been closed and a reply automatically delivered, a step had been taken which prevented the plaintiffs discontinuing without leave, under Order 26, Rule 1. His Lordship said he could not certify the particulars as proper without trying the action. Mr. Grey, who appeared in support of the summons, thought the facts were such as to justify the order being made. He saw the plaintiffs had previously brought a similar action against the Globe Light Company, Limited, upon the same patent, in which particulars of objection were given; and Mr. Justice Joyce found in favour of the defendants, and certified that some portions of the particulars were reasonable and proper. Mr. Gordon having been heard in opposition to the summons, his Lordship said a Judge had no means of ascertaining whether or not the particulars were proper unless he tried the action; and it had been decided in the case of the *Acetylene Illuminating Company v. United Alkali Company* that defendants could not get the costs of the particulars when the action was discontinued. The summons was therefore dismissed with costs; these to be set off against those payable by the plaintiffs.

The Teignmouth Reservoir Dispute.

It may be remembered that a dispute arose some time ago between the Teignmouth Urban District Council and a Contractor named Slocombe, who had undertaken to carry out certain alterations and repairs to a reservoir, for about £6000. The Council were dissatisfied with the way in which the work had been done, and the matter was referred to Mr. Erskine Pollock, K.C., Official Referee. He awarded the Council £2000; and from this decision Mr. Slocombe appealed to a Divisional Court early this year. (See "JOURNAL," Vol. LXXXIX., p. 176.) After considerable argument, the appeal was dismissed with costs; their Lordships considering that there was abundant evidence to support the finding of the Referee. The matter was taken to the Court of Appeal, who last Wednesday confirmed the decision of the Lower Court. The Master of the Rolls said the Official Referee had come to the conclusion that there were such radical defects in some of the work as to justify him in holding that the defendant should pay the damages mentioned. The Referee was of opinion that, although alterations were assented to, they did not relieve the Contractor from putting down concrete to the depth of the 12 inches originally prescribed, nor did they justify him in putting down half bricks instead of whole ones. He also found that the bricks were not laid at all in the way prescribed; while as regarded the concrete, both in quality and quantity, that actually put in failed radically. The result of these failures, taken together, was that, instead of having a good foundation for the concrete, the plaintiffs had an imperfect foundation made up of half bricks and rubbish; and they also had concrete of inferior quality. The consequence was a worthless reservoir instead of a sound one. There was ample evidence, he held, to justify the Referee's findings. He saw no ground whatever for the appeal, and considered that it should be dismissed with costs. Lords Justices Romer and Mathew concurred. The appeal was accordingly dismissed.

The Devonport Water Arbitration.

The long and costly litigation arising out of the purchase of the undertaking of the Devonport Water Company by the Corporation, has received a fresh lease of life, as the Court of Appeal (consisting of the Master of the Rolls and Lords Justices Romer and Mathew) on Friday remitted the whole matter back to the Umpire. The arbitration was held, it may be remembered, under an Act passed in 1902, by virtue of which the Corporation obtained power to purchase the water-works, the terms being that the price should be ascertained by arbitration, and that upon payment of the amount determined, the Corporation might enter into possession. A large part of the Company's revenue had been derived from the Admiralty, in respect of the Dockyard; £425 being paid for a supply which had been in existence from the time of the passing of the Water Company's original Act, and £2007 for a variety of supplies for which the Admiralty had made later contracts with the Company. A dispute arose as to whether, under the terms of the Act incorporating the Company, they were bound to make the whole of the supply to the Admiralty for the one sum of £425, or whether they were entitled to separate payment for the other supplies; the question being what part of the revenue was ordinary, which could be capitalized in the event of a purchase. Mr. A. J. Ram, K.C., the Umpire appointed by the Arbitrators (Messrs. G. H. Hill and Charles Hawksley) in succession to the late Sir Frederick Bramwell, had stated a special case, which was argued before Mr. Justice Phillimore last December, as reported in the "JOURNAL" at the time. (See Vol. LXXXVIII., p. 984.) Both sides being dissatisfied with his decision, they appealed to the Higher Court; and after the question had been argued for two days, their Lordships, as already mentioned, sent the case back to Mr. Ram for further facts to be stated.

Claim for Water Supplied to Flats.

At the Westminster County Court, on Monday last week, before his Honour Deputy-Judge Bevan, the Metropolitan Water Board sued Mr. Mark Brummitt for the sum of £39 4s. 8d. for water supplied to certain property of which it was alleged he was the legal owner. Mr. D. Collings appeared for the plaintiffs; Mr. E. Bankes represented the defendant. Mr. S. F. Ever, who took over the collectorship of the Board in December, 1904, said the amount owing on the water-rate of the property, which consisted of nine flats in Francis Street, Tottenham Court Road, was £39 5s. 2d. The defendant took possession on Nov. 8, 1904. He (witness) subsequently heard that the Union Property Company were the owners. He accordingly sued them, and they paid £3 5s. 2d. into Court. This sum had been accepted on account. Mr. F. R. John, the collector of King's taxes, said he applied to Mr. Brummitt for the taxes, and a Mr. Barr came to see him, evidently representing Mr. Brummitt. Mr. Barr told him that Mr. Brummitt came into possession on Nov. 8, 1904, and all the flats were empty from that date until March 25 last, excepting one which became tenantless on the 8th of January. It was in respect of this one that the Property Company had paid the £3 5s. 2d. The Company, of which Mr. Brummitt was a Director, entered into possession on Dec. 8, 1904. After several witnesses had given evidence, the defendant was called, and stated that he entered into possession of the premises on Nov. 8, 1904; but the property passed from him to the Company a month later; and a contract was then entered into between them. He took possession for the Company, as it was not quite formed at the time. After some legal argument, his Honour said he thought the defendant was the owner to the 25th of December; and he could not do otherwise than give judgment for the plaintiffs, with costs on the higher scale in the event of an appeal.

The Fire Risk of Electric Wires.—One more has been added to the long list of fires for which the fusing of electric wires must be held responsible. The Bible Christian Church at Salford has been considerably damaged, and the organ destroyed, by a conflagration owing its origin to this cause.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the Proprietors was held last Tuesday at the Cannon Street Hotel, E.C.—Mr. J. HORSLEY PALMER in the chair.

The SECRETARY (Mr. R. W. Wilson) read the notice convening the meeting, and subsequently the following report of the Directors :—

The results of the Association's operations during the past six months have been satisfactory; and a comparison of them with those of the corresponding period of last year illustrates the steady progress of the business.

At the close of the past half year, the number of consumers amounted to 315,665, as against 283,858 on the 30th of June, 1904—an increase of 31,807, or 11·2 per cent. The number of meters employed amounted to 387,565, which included 75,640 prepayment meters, or 19 per cent. of the total. The increase in the number of meters placed was 38,629, which comprised 11,937, or over 30 per cent. prepayment meters.

The quantity of gas sold during the half year under review exhibited an increase of 5·74 per cent. upon that of the corresponding six months of 1904.

The weather during the first quarter was very mild; and business in Germany was much disturbed owing to the strike of the coal miners in Westphalia. Otherwise the increase would no doubt have been greater.

New districts added to the Association's area of supply required the laying of over 37 miles of new mains and many thousands of feet of service-pipes. On the 30th of June last, the mains measured 2115 miles 477 yards.

The percentage of gas not paid for was only 4·65 per cent. of the gas made; and as this figure includes 1·16 per cent. which was used on the works, the actual unaccounted-for gas was but 3½ per cent. of the total quantity sent out.

The coal carbonized represented 424,265 metric tons, and the production of gas averaged 305 cubic metres per 1000 kilos., or 10,933 cubic feet per English ton. The coal employed came from widely different sources—from France, from Westphalia and Silesia in Germany, from Bohemia, from Austria, and from England. The quantity of English coal, which was principally used in Berlin, Antwerp, and Brussels, amounted to 123,000 tons. The cost of the coal delivered into the retort-house averaged 17s. 8d., or about 1d. less per ton than in the corresponding half year.

The bye-products derived from the distillation of the coal (coke, tar, and ammonia) found a ready sale—coke at improved prices, tar and ammonia at about the same average price as in the corresponding six months.

The net cost of coal was 7s. 0½d. per ton, or about 10d. less than in the corresponding half year.

The net receipts for gas were somewhat adversely affected by reductions in price, and by larger contributions which have to be paid to several of the Municipalities with which the Association have contracts. The profit of the half year, however, which amounts to £218,162, represents an increase of £7479, or 3½ per cent.

At Antwerp, our Engineer was successful in obtaining reasonable prices for the tools, buildings, &c., on the Hoboken site, formerly known as the Vulcain Belge Shipbuilding Company. The electrical installation, which was a very complete one of its kind, will be retained by the Association and utilized for the gas-works which the Directors contemplate soon taking in hand. The purchase of this property has been a favourable one for the Association. Some land situated in another part of Antwerp, which was no longer required for the business, was disposed of.

A monopoly of the supply of gas to private consumers until the year 1935 was secured in the suburban Commune of Schooten.

After prolonged negotiations, the Directors' secured a twenty years' prolongation—till the year 1961—of their monopoly of the gas supply in the Commune of Deutsch-Wilmersdorf, a suburban district in the south-west of Berlin. They also obtained a ten and twenty years' prolongation respectively of their exclusive concessions for the supply of gas in Nieder-Shönhausen and Alt-Weissensee.

The various new works in progress at Mariendorf, referred to in recent reports, were actively proceeded with. Coal discharging and conveying plant is in course of erection on the Holzmarktstrasse works. Mechanical coke conveyors on the De Brouwer system are being installed at the Gitschinerstrasse works, and will greatly add to the efficiency of the inclined-retort installations there. At the Schöneberg works, four additional hydraulic stoking machines (which originally came from Vienna) will be brought into use this winter.

At Brussels, the Directors secured a monopoly of the supply of gas and electricity until the year 1939 in the suburban communes of Linkebeek and Zellick.

At Flushing, with a view to the possible requirements of the future, the Directors took advantage of an opportunity of securing some property contiguous to the works.

At Frankfort-on-Main, the erection of the new gasholder in an existing tank at the Obermainstrasse works was practically completed. Good progress was also made with the construction of the new tank and gasholder at the Bockenheim works.

The Directors have secured a 25 years' prolongation—*i.e.*, until 1950—of their gas monopoly in the town of Linden, which is at present supplied from the Hanover works. The Directors contemplate the erection of a separate works in Linden territory.

At the Hanover works, the installation of West's stoking machinery, for which compressed air is used, was completed and put in action.

At Lille, the eight settings of horizontal through retorts with electrical charging and discharging machinery—on the De Brouwer system—at the Vauban works were completed; and in February the manufacture of gas at the St. André works was discontinued. The resultant economy fully answers expectations.

Some property immediately adjoining the Vauban works was acquired on favourable terms.

At Vienna, the Directors continued—as occasion offered—to dispose of land which was no longer required.

In conclusion, the Directors desire to draw the attention of the proprietors to the accounts for the half year ended the 30th of June last. These have been duly audited; and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 5 per cent. for the half year ended the 30th of June last, payable, free of income-tax, on and after Tuesday, the 14th inst.

The CHAIRMAN moved the adoption of the Directors' report. In doing so, he said those of the proprietors who had been in the habit of attending the half-yearly meetings would probably have noticed that the report had departed from its old stereotyped form, and gave much fuller particulars and details than had been usual. About this, there could be no complaint at all on the part of the proprietors; the only person who suffered being the Chairman, because it had taken away from him the privilege of addressing the meeting on many of the points included in the report. But there were a good many matters of interest regarding the working and proceedings of the last half year upon which he would make a few remarks. Probably the most important of these items were: The progress of the Association; the coal strike which took place in North Germany during last spring; the prolongation of some of the concessions of the Association; the additions to the works; and, combined with the last item, he should say a few words regarding vertical retorts.

PROGRESS OF THE BUSINESS.

With respect to the progress of the Association, the increase in the number of their consumers, as the report told them, was 31,807. This was an enormous addition. It was not quite a record; but it was a good second, because in the twelve months ending June 30, 1904, there were nearly 100 more consumers connected than the number he mentioned as having been taken on last year. The cry was "Still they come;" and in a report which Sir Charles Jessel and Mr. Tindall had just before the meeting handed in to the Board (having only the day before returned from a visit to the Continent), they said concerning Aix that there were a number of consumers waiting to be attached to the mains. They were, in fact, only waiting owing to the paucity of fitters to do the work. In connection with this enormous number of new consumers, he (the Chairman) might say that the meter-works which were established in Berlin, on their Mariendorf land, some few years ago were built on a very generous scale. When he first visited these works, he thought that they were built on too generous a scale; but this year they had not been able to pick up the work required of the factory. They had been unable to fill the orders from their own stations, much less take orders from outside German corporation works or German gas companies, who were always applying for the meters of the Association, as they knew they were of such extraordinarily good quality. Of course, the bulk of the new consumers they were connecting nowadays belonged to the humbler class. In England, the humbler class had some time since seen the advantage of taking gas; but on the Continent it was only during the last three or four years that a very large number of the small householders had seen the benefit of having at their doors, and taking into their houses, cheap gas for lighting and for heating, and for cooking their meals. Therefore it was that the Directors particularly put in their report that about 12,000 small and prepayment meters had been installed during the last twelve months. He might say with regard to all these additional consumers, that it was wonderful what a small amount of bad debts the Association had made during the six months under review. The amount of bad debts for all classes of consumers had only been about £800; and the sum the Association had cashed for gas alone was over £800,000.

WESTPHALIAN COAL STRIKE AND THE DIRECTORS' ACTION.

With reference to the great coal strike which took place in Westphalia in the early spring of this year, he might say at once that the Association were in no way affected by it. By the terms of their contracts, they were obliged to keep a certain stock of coal at their works; and it had always been the policy of the Board to keep a very considerable stock there, because they had to meet contingencies of weather during the winter time in North Germany that did not occur in England. Therefore they found themselves in the happy position of having a very good stock of coal when the strike broke out; and to show the individuals who were interested in the strike that they could supply the works with coal, the Directors put into Hanover two cargoes of English coal at slightly increased prices; and as their Manager at Aix was a little nervous with regard to his supplies, they also put in coal there from England, *via* Belgium, and so kept him perfectly happy. While speaking on the subject of coal, he should like to point out to the proprietors how very heavily the tax on coal pressed on the Association. They would be shipping during the coming season probably 270,000 tons of English coal to the Continent; and on this they would have to pay 1s. a ton. And not only that. Directly the tax was put on, the people who controlled the Continental coal mines immediately raised their prices for coal by a corresponding amount. So that, practically speaking, they had to pay the tax on the 900,000 tons that the Association used in the course of their operations.

BYE-PRODUCTS.

Referring to coal, naturally led him on to coke and the other bye-products. At the last meeting, Sir John Runtz asked the Chairman to give a few particulars with reference to the bye-products, and the way the Association dealt with them. He had got out for his information a few figures from the statistics drawn up by the Secretary every half year for the benefit of the Directors. He might say, in the first place, that the effect of the coal strike, as regarded coke, was financially good for the Association. Naturally the price of coke kept up; and therefore they were in a happier position than their brothers in gas making in England, who had seen prices diminish during the last nine months. The consequence was the coke of the Association brought in an average of 16s. 10d. per ton. Tar under contract and local small sales realized rather more than 1¾d. per gallon. For sulphate, they obtained an average price of £12 6s. 3d. per ton; their product having a high reputation on the Continent. Muriate of ammonia (which was shipped almost entirely to the American market on account of its extreme purity) realized £21 16s. 10d. per ton.

NEW SITE AT ANTWERP.

Allusion was made in the report to the Hoboken land, which the Directors purchased rather more than a year ago (he thought just about this time last year) for the purposes of the Association at Antwerp. On the land, there were a great many buildings of value, and some really first-class machinery adapted to ship-building. It was necessary for the Directors to clear all this machinery with the exception of the

electrical plant; and it was first of all offered *en bloc*. They did not get any satisfactory *en bloc* offers; and so they decided to sell the plant piecemeal. The Directors' policy in this matter had turned out extremely well; and the result was that the land, having cost them £86,000, now stood them in £51,000. The area was 65 acres; and the price in the books of the Association was considerably below the market value of land in such a neighbourhood. The Directors were having plans prepared for complete new gas-works on this site; and he had no doubt that, in the course of a few years, they would be able to report to the proprietors that they had a model works on the land.

PROLONGATION OF CONCESSIONS.

With regard to the prolongation of concessions to which he had alluded, they were of considerable importance to the Company, because the principal one was at Wilmersdorf, which was one of the most progressive suburbs in the neighbourhood of Berlin. It might be compared almost to South Kensington. The Municipality of Wilmersdorf were a very shrewd, capable, businesslike lot of men; and when the Directors approached them for a prolongation of their concession, they imposed somewhat onerous terms. He hoped his words that day would reach their ears. The terms were very onerous indeed; but, after carefully considering the matter, the Board thought it was to the interest of the Association and its future that they should agree to what the Municipality imposed. The Association had to supply a number of public lamps absolutely free of cost. They had also to contribute a large annual sum to the Commune's exchequer. It was in this way the municipalities on the Continent made monopoly save the rates—the inhabitants having a share in the receipts of an undertaking, be it gas, electricity, or tramway, without any risk of capital whatever, and in most cases irrespective of the fact whether the undertaking paid or not. He thought this was a much sounder policy on the part of corporations than investing large sums in ventures which they could not efficiently manage. Then the other most important prolongation was the one at Linden. This was a large suburb—in fact, was almost part—of the city of Hanover. The gas-works which at present supplied both Hanover and Linden were in the territory of Hanover; and, at the end of the concession of the Association there, they had to give up these works with the mains, while under the contract with Linden the mains situated in the Linden territory were to become the property of that Commune at the same date—1925. The Directors had prolonged the contract at Linden to 1950; and it would therefore be necessary at some time in the future to build works in the outskirts of Linden to supply this growing town—it could not be called a suburb—so that if they did not (as he hoped they would do) prolong the concession with Hanover, they would be in the position of being able to light Linden until 1950.

ENGINEERING WORK—DESSAU VERTICAL RETORT SYSTEM.

With regard to the engineering work that had been done during the six months ending June 30, the principal work had been at Mariendorf, which was well known to the proprietors as being the large works of the Association near Berlin. At Frankfort, where their business was increasing very much, they had built a large new gasholder and had replaced by a triple-lift holder a small one which was built, he thought, something like fifty years ago. To return to Mariendorf, the new works there consisted of docks to be connected with the new Tetlow Canal, and a large, new gasholder—the largest on the Continent; and they had also been building a new section of the retort-house. It was the intention of the Directors to place in the retort-house a series of beds of vertical retorts; and it was in regard to this system of vertical retorts that he wished to say a few words particularly that day. Not being a skilled engineer himself, he should take a great many of his remarks from very able reports and letters which had been forwarded from time to time by their Chief Engineer at Berlin, Mr. Körting, who from the very first had associated himself with the Directors of the German Continental Gas Company and Dr. Bueb (as did also their late Engineer, Mr. Edward Drory), in exploiting this new system. It was just two years ago since he (the Chairman) referred to this matter; and he then said he hoped on some future day to be able to report the absolutely practical working of such a setting. Since that day experiments with the vertical system had been carefully made at Dessau, and by the Association at Mariendorf. The merits of the system having been clearly proved, final experiments had been made at Dessau with a setting 4 metres high, and at Mariendorf, with a view to greater economy and better results, with retorts 5 metres high. The Dessau results were so satisfactory that it was decided to put the system into practical use there, and two settings of ten retorts, with coke-conveying plant, were erected. These, after three months of practical working in supplying the town with gas, confirmed those interested in the system that they had discovered the setting of the future. A report on the demonstration of the working (to which demonstration a great many engineers went) was to be found in the "JOURNAL OF GAS LIGHTING" for Sept. 26 last. Regarding the trials at the Mariendorf works, he should explain the reason why retorts 5 metres high were experimented with. It was that the results achieved by them with the inclined system of retorts 4·8 metres in length had been so satisfactory that the vertical system would only be satisfactory by improving on the results of those inclined retorts; and this could only be done by having vertical retorts of a certain given capacity. Their experiments with the longer vertical retort had not at present resulted so favourably as with the shorter one. Now he must turn to Mr. Körting's report to the Directors, because he knew that this question was of very great interest to gentlemen connected with the gas profession. This was his explanation:

I am sorry to report that this furnace is not quite ready yet. The construction is similar to that of the Dessau furnaces, and the principal features—especially the generator, the recuperation, and their relative position with regard to the retorts, the flues in the oven, the mechanism of the mouthpieces, &c., certainly mean a great improvement, and may be regarded as very nearly the definite arrangement. The furnace made, as you are aware, a very good impression when it came into action: but, when we tested the gas, we found the illuminating power rather poor. Further investigations showed that the furnace was too hot at the top, so that the charge there was burnt off at an earlier stage than that at the bottom. In consequence, the last gas coming from there had to pass a layer of hot coke before entering the hydraulic. The retorts having a considerable taper, and, in consequence, the quantity of coal being much larger in the bottom than in the top parts, it is essential to the good working of the furnace that the heat should diminish from the bottom to the top in exactly the same ratio as the coal.

In the furnace with 4 metre retorts, the initial temperature at the point where carbonic oxide and air mingle is about 1300° C., and the temperature at the point where the gases pass into the recuperation, 900°. The additional metre, however, in the length of the retort causes such a drop in the temperature, that it is no longer sufficient for carbonizing the coal at the top, whereas an increase in the bottom temperature would endanger the durability of the retort. In consequence, a second influx of secondary air or a second combustion was provided; but this did not prove to be in the proper place, being too much towards the top. The retorts were not hot enough below, and too hot above. There was no help for it; and we were obliged to let the furnace down, and to provide means for the second combustion at another point. We are just now making the few and simple alterations which are necessary. Negative results of this kind are by no means to be despised, because they add to our experience nearly as much as positive ones. But at the present moment, they are very inopportune, as we have to come shortly to a decision as to the kind of furnace to erect next year.

In these circumstances, I am firmly convinced that I cannot propose to the Board the erection of verticals before our trial furnace has given satisfactory results for at least half a year.

It may be wondered why I do not, in this case, propose the 4 metre retorts to begin with. These are all right; and for Dessau with horizontals, or Zürich, with 3·6 metre slopers, mean an improvement. In Mariendorf, however, the verticals must compete with 4·8 metre slopers, which have hitherto given very satisfactory results. A retort-house with verticals must have at least the same producing power as a Coze house of about the same length and breadth. This result can only be brought about by the longer retorts, which, in consequence, I have adopted from the beginning.

Before investing considerable sums in a large installation, there should be some proof of sufficient durability of the retorts; for on this depends the automatic sliding out of the coke, or, in other words, the labour-saving qualities of the system.

After receiving this report, the Directors decided that in the new retort-house—at any rate, in the first half—they should instal inclined retorts on the same system as in the first house, with some minor improvements with regard to conveying plant.

THE WORKMEN.

Respecting their workmen, he (the Chairman) had no doubt that the proprietors had noticed in the papers there had been a great strike among the electrical workers in Berlin. The Association were not affected by the strike in any way. They were on good terms with their men. Certainly they had had to increase their wages at various places during the past year, but the workmen generally were as contented as workmen usually were.

RE-ARRANGEMENT OF THE ACCOUNTS.

There had been a small alteration in the way the accounts were drawn up. There were prior to this half-year a balance-sheet, and below it two further accounts—one called the depreciation account and the other the reserve account. There was no particular object in having these two accounts separate from the balance-sheet; and, in accordance with the wishes of the Finance Committee, they had brought the accounts into the balance-sheet. This had been approved by the gentlemen who audited the accounts, as shown by their appending a note to the balance-sheet to this effect: "We notice the alteration and simplification of the balance-sheet, and approve thereof." He (the Chairman) mentioned this in case any proprietor who had been, or who might go, to the office noticed the balance-sheet was somewhat different in form from what it was six months ago.

DIRECTORIAL VISITS TO THE STATIONS.

During the past year, the Directors had been assiduous in visiting the stations, and in making reports upon them. Colonel Le Roy Lewis had visited a good many of the French stations, Sir Charles Jessel and Mr. Tindall only returned the previous day from an extended tour of a number of stations in Germany and Belgium, and Mr. Woodall had only just returned from Bohemia, Vienna, and other stations. These Directors reported to him (the Chairman) that they found everything in perfect order, and all the stations well equipped for the business they would have to do during the coming winter. Might he be allowed to say in addition that the proprietors, he thought, owed a great debt of gratitude to Mr. Woodall for the considerable amount of time he placed at the disposal of the Association in travelling abroad, and for the way in which he applied his extensive knowledge of gas engineering details to further the engineering department of the Association.

THE DEATH OF MR. CLARENCE PIGOU.

Before he (the Chairman) sat down, there was a melancholy matter about which he had to speak. He referred to the loss sustained by the Association by the death of Mr. Clarence George Pigou, which took place only a month ago. He was, apart from being a very able Director of the Association, a great personal friend. Mr. Pigou was a Director of the Association for 27 years; and in the earlier part of his career with the Association, he did them extraordinarily good service. One of the most brilliant things he ever did, and of which he was exceedingly proud, was the renewal of the concession at Amsterdam five years after he joined the Board. He took it in hand in 1880—only two years after his appointment as a Director, though the concession was not signed until three years after. During these three years, the amount of work Mr. Pigou did for the Association in connection with the contract was perfectly remarkable. He remembered the Dutch papers chaffingly alluding to the Board of the Imperial Continental Gas Association having sent out a young military officer of no experience to compete with two Syndicates composed of the cutest financial people of France and Belgium. But, with that mathematical brain of his, he was able to secure for the Association the Amsterdam concession, which redounded enormously on the Continent to the credit of the Association. His death had taken place so recently that the Board had not yet filled his place. But before the proprietors met again in six months' time he (the Chairman) expected to introduce to them a gentleman who, they hoped, would do as good work on the Board as Mr. Pigou had done for them.

The DEPUTY-CHAIRMAN (Mr. Arthur Lucas) seconded the motion.

Sir JOHN RUNTZ said the proprietors ought not to allow the motion to pass without a word of praise to the Chairman and Directors for their continued excellent management of the Association. The Chairman had kindly referred to the question he put last half year in connection with the residuals. He was glad the Chairman had given them some details, because they only brought out what he had anticipated—that the residuals department was as well looked after as any of the other departments. He was quite sure the proprietors were well served, not only by the Directors but by the Secretary and the management generally. He incerely hoped the prosperity of the Association would continue as in the past.

The motion was unanimously carried.

Proposed by the CHAIRMAN, seconded by Mr. J. H. BIRCHENOUGH, a dividend at the rate of 5 per cent. per annum on the £3,800,000 stock was declared, payable free of income-tax.

Mr. TINDALL said they must not part without recording a vote of thanks to the Secretary and staff in London and to the Engineers and their staffs on the Continent. The Directors did their best for the interests of the Association; but they felt, and they wished the proprietors to feel, how much they owed to their staff, both in London and on the Continent, on whom the success of the Association greatly depended. Nobody knew better than the Directors how much the Association were indebted to their Secretary. He was a most faithful and loyal servant of the Association. In company with Sir Charles Jessel, he (Mr. Tindall) had just been abroad, and had seen with his own eyes the good work the Engineers were doing. They owed it to their faithfulness, their ability, and their loyalty that the Association was so prosperous. He therefore moved a resolution thanking the officers and staff both at home and on the Continent.

Sir E. CHANDOS LEIGH seconded the motion, which was unanimously carried.

Mr. J. REESON moved a vote of thanks to the Chairman and Directors for their able conduct of the affairs of the Association. Among the points that had particularly struck him were the development of the works, in conjunction with modern methods of manufacture; and this showed considerable enterprise on the part of the Directors. Then there was their able management of the coal business, which, notwithstanding the strike, resulted, he was happy to notice during the reading of the report, in a slight diminution in the price. The Directors had also shown good diplomatic action in accepting the terms for the extension of the concessions. The gaining of these extensions was most important to the Association; and he thought they ought to congratulate the Directors and themselves upon the result.

Sir J. RUNTZ seconded the motion, which was cordially passed.

The CHAIRMAN's acknowledgment concluded the proceedings.

DANISH GAS COMPANY.

The Fifty-first Annual General Meeting of this Company was held at the London Offices, No. 13, Victoria Street, S.W., last Thursday—Mr. CORBET WOODALL in the chair.

The LONDON AGENT (Mr. H. G. Warren) read the notice convening the meeting, and the minutes of the previous meeting; and the report and accounts (which were noticed in the "JOURNAL" for the 31st ult., p. 324) were taken as read.

The CHAIRMAN, in moving the adoption of the report of the Directors and the accounts for the year ending June 30, said that he would commence the few observations he intended to make in commending the resolution to the shareholders by referring to the report itself, because he understood the fact that they were reducing the amount carried forward was exercising the minds of one or two of the shareholders as to whether it was a sign of decadence. The accounts showed that the net revenue balance for the year was £53,818, or £6900 less than was shown in the accounts for 1904. The carry-forward was, after providing for dividends and all charges, £26,383, which was again a reduction. But at the same time there had been an increase in the quantity of gas sold of 4½ per cent. Now he assured them that there was nothing in this apparent decline of profit to cause the slightest anxiety. With a very large undivided balance of net revenue, the Directors were not greatly concerned that each year should show an addition to it; and they did not hesitate to charge to the current account items of expenditure which, in less prosperous circumstances, they might put in suspense and deal with over a term of years. He would illustrate what he meant. In the town of Viborg, the profit shown this year was not only not sufficient to pay the dividend on capital invested there, but it was not enough by some hundreds of pounds to pay the station's contribution to the amortization fund. But there was not the slightest reason why there should be any anxiety. It had so happened that large and important works of reconstruction had been needed in the account year; and these had been charged direct instead of being spread over a more or less lengthy period. This could only be done with a Company like their own, having a number of units which averaged satisfactorily. As with the stations, so with the years. If in one the profit was below the average, they did not try to make it appear better by postponing necessary work. They knew that to maintain the whole undertaking in efficiency was a sound policy, and a guarantee for future success. But if they looked at what had been done in the past year, they found a very creditable record. They had carried to the reserve and depreciation funds nearly £20,000; they had spent in repairs, renewals, and depreciation of plant and apparatus £5900 more than in 1904. The Jubilee gratuities, to which reference was made last year, amounted to £1614; and there had been a contribution to the pension fund of £1200. In addition to this, they had had to pay £640 more for taxation than hitherto. The lower prices received for coke, compared with 1904, decreased the receipts by £7350. This was to a large extent met by better results from tar and ammonia, which accounted for £2370; and a reduction in the cost of coal of £4380. These two very nearly wiped out the loss on coke. But in Denmark, the price of gas was regulated by the cost of coal delivered free on board ship at Newcastle. This year, because of the lower price they paid for coal, they had to allow to the consumers £1230; but inasmuch as the cost of coal (after deducting the receipts from residuals) was higher than in the previous year, the consumers got the whole advantage of this, and the Company no compensating gain. Therefore taking these figures together, he had no hesitation in saying that the condition of the Company was as prosperous and as promising as it had been at any time during his acquaintance with it. The shareholders were aware that they had paid the dividend on the preference shares in July this year, instead of, as was usual, in October. It was decided that the 6 per cent. preference shares should be paid off, and replaced by an equal number bearing 5 per cent.; and in order to do this, they had to pay up to June 30, when they matured. This meant that the holders of the new issue would have to wait until March for their next dividend—nine months—and to those who were new shareholders, this was rather a hardship. The Directors took advice as to whether they could meet the difficulty by a bonus payment to compensate for the three months; but they were unable to find a way out, so the shareholders must bear it. The matter would right itself when this issue was paid off, which might be a satisfaction to their children. The chief items of capital expenditure had been on water-gas and other plant for the new works at Flensburg, £5400; extensions at Strandvei, £8000; land at Randers, £2100; and part cost of mains and services, £5000. He was glad to say that, notwithstanding the large amount of capital that had been spent in recent years, the total bore a reducing ratio to the amount of business done. The charge for dividend was also less from year to year. Within the five years from 1900 to date, the capital per million cubic feet of gas sold had fallen from £913 to £821; and the dividend and interest charges had been reduced by about ½d. per 1000 feet, although the dividend, as they knew, had been increased. The only other matter of account to which he would refer was reserve. During the year these funds had increased from £120,000 to £136,000; and the investments thereout from £63,000 to £77,000. Although the Directors recognized that there was no more profitable investment for their savings than in the Company itself, yet, constituted as they were—especially with regard to their contracts, which reached their termination at various periods—it seemed essential that there should be a certain amount of cash available at short notice. Therefore they were investing a considerable portion of the surplus of the Company in outside securities easily realizable. The limit of these investments would be £100,000. Turning to Denmark, he was not yet able to report the conclusion of all formalities at Flensburg; but the erection of a holder on the new site was in hand, as also the proving of the foundations for the buildings to be erected. They had received a letter that morning from the Engineer there saying that the Burgomaster and Council were equally anxious with the Company to get the matter settled; and, at any rate, now the Directors had no hesitation in going on with the work. Application had been made to them to furnish electricity for the operation of a tramway system in the neighbourhood of Copenhagen; and they had agreed to entertain the proposal if a contract could be made for private and public lighting in the same area. Negotiations were also in progress for a contract to supply gas to an area lying between Copenhagen and Elsinore. At Frederiksberg and Strandvei extensions on a large scale must shortly be made. He had an opportunity of going over these works a fortnight ago; and as the time was getting very close, they were making arrangements to put the work in hand. The visiting Directors were well pleased with the condition of the works and the state of the Company's affairs. Mr. Edwards, the new Chief Engineer, had a thorough grasp of the business; and the Directors were fully satisfied that in him the Company had a very capable and thoroughly reliable chief officer.

Lieutenant-Colonel T. H. LEWIN seconded the motion.

Mr. BIDDER asked if they might take it that there had been quite exceptional capital expenditure during the past year.

The CHAIRMAN said there had not been any exceptional capital expenditure, but exceptional expenditure out of revenue on renewals. The actual profits had not decreased, except by reason of the bad return from coke. Coke was now very much better; and the price of coal was going up, which meant that their price for gas would go up, instead of going down.

The resolution was then carried unanimously.

The CHAIRMAN next moved, and Lieut.-Col. C. M. DAVIDSON seconded, the payment of a final dividend of 5 per cent. for the year ending June 30 on the ordinary shares; and this was agreed to.

Mr. C. CLARKE then moved a resolution of which he gave notice last year—that a sum not exceeding £500 per annum should be available annually for extra remuneration to those Directors travelling to Denmark on the business of the Company. He said the Company was getting very much larger, and required the Directors to be abroad more often than formerly; and he was sure the proprietors would not like them to be put to any disadvantage owing to this.

Mr. WILKINSON, in seconding, said the Directors had done so much in the past in going to the stations of the Company, that the least the shareholders could do was to pay handsomely for their services.

Mr. J. REESON supported the proposal; and it was unanimously agreed to.

The CHAIRMAN having returned thanks on behalf of himself and his colleagues,

The Auditors (Mr. Edwin Waterhouse, F.C.A., and Major E. A. Critchley) were re-appointed, on the motion of Mr. WARING, seconded by Mr. REESON.

On the proposition of Mr. WARING, seconded by Mr. WILKINS, a vote of thanks was accorded to the Chairman, Directors, and officers for the way they had attended to the business of the Company.

The CHAIRMAN, in acknowledgment, said he was glad the officers were included in the vote, as there was the greatest reason to be satisfied with the services rendered by them. Mr. Warren did his work admirably in London; and, as he had already said, Mr. Edwards was proving a most excellent officer in Denmark. Mr. Cridland, too, he was glad to say, was now in good health, and as popular as ever.

The proceedings then closed.

SUPPLY OF ELECTRICAL ENERGY IN LONDON.

Objections to the County Council's Scheme.

At the Meeting of the London County Council to-day, the report of the Highways Committee, recommending that the Council should promote a Bill next session to enable them to generate and supply electricity in bulk in London and certain surrounding districts, will be brought up for discussion. The principal features of the report were noticed in the "JOURNAL" for the 31st ult. (p. 328). In connection with the proposals of the Highways Committee, the Finance Committee will submit a long report, of which the following is a summary.

The Committee begin by pointing out that the authority to be sought includes power (1) to supply electrical energy in bulk throughout the whole of the specified area; and (2) to supply energy to large individual consumers—as, for instance, railway, canal, and tramway companies, or authorities where these undertakings extend over more than one local government area. In considering this most important proposal, the Committee say they have found themselves in a position of great difficulty, owing to the absence of any financial data to guide them in advising the Council. Time had not permitted a definite scheme to be worked out by the Highways Committee; and their report to the Council only outlines in very general terms the proposals they recommend should be placed before Parliament. The Finance Committee are, therefore, strongly of opinion that in a matter of this magnitude, raising financial issues of the greatest importance, the Council should, before committing themselves to the undertaking, have before them a definite and carefully worked out scheme. In the absence of any such scheme, they had given such consideration to the subject as time and the limited amount of information at disposal had allowed.

The Committee then go on to suggest that the two main questions on which the Council would naturally desire to have their advice were: (1) Are there reasonable grounds for thinking that the enterprise will be self-supporting? and (2) Can the large sum of capital required be raised without affecting the credit of the Council? The first of these considerations is one of vital concern, for the Committee could not suppose that the Council would agree to invest some millions of public money in an undertaking of this kind without substantial reasons for the belief that it would be at least self-supporting—in other words, that the profit on working would be sufficient to pay the interest on, and provide for the repayment of, the money borrowed. The credit of the ratepayers would in any case be pledged for the raising of the capital; but the Council would no doubt agree that beyond this no further assistance should be looked for from the rates. The Council would note that the report of the Highways Committee offers no guidance upon this matter beyond the general statement that, in the Committee's opinion, it will be quite practicable "to put forward a satisfactory scheme." In these circumstances, the Finance Committee have endeavoured to assist the Council to a conclusion from a consideration of the estimates and financial data placed by the Power Company before Parliament last session in support of their scheme, with which the Highways Committee's proposals are in a measure comparable.

The Highways Committee do not say what capital would be required; but the Finance Committee have assumed that a sum of about £3,000,000 would be needed in the first instance for a large generating-station with mains and subsidiary works. The expenditure of this money would be spread over five or six years; and it is obvious, therefore, that there must inevitably be a long period during which the capital would be unremunerative. The Power Company proposed to meet this difficulty by obtaining authority to pay interest out of capital at the rate of 3 per cent. up to a maximum of £310,000. The Committee point out that there is no precedent for a municipal body being given such a power; and they must assume, therefore, that the interest on the capital raised would have to be defrayed out of the rates year by year. They estimate that for interest payable on £3,000,000 during the construction of the works an aggregate sum of about £380,000 would have to be so provided. This is a consideration which they do not think the Council have sufficiently appreciated in the past. There are precedents for the postponement for a few years of the provision in regard to the sinking fund; and they have therefore assumed that no charge under this head would in the earlier years fall upon the ratepayers. The ultimate debt charges, assuming that the expenditure on land and buildings were spread over 60 years, and the cost of machinery, trunk mains, &c., over 25 years, may be taken roughly at about 6 per cent., which, on an initial outlay of £3,000,000, would represent an annual charge of £180,000 a year.

The next question taken up by the Committee relates to the possibility of the undertaking being remunerative. The Power Company calculated on a total output of 133,500,000 units in the next five years, and on 600,000,000 units in eleven years, when the works would be completed. The output of the existing undertakers during the year 1903-4 was: Companies, 85,933,026 units; Borough Councils, 27,963,137 units—a total of 113,896,163 units. On the basis of the Power Company's calculations, it would be necessary for the Council to sell 200,000,000 units to realize a profit of £180,000 a year, even if the working expenses should prove to be not higher than those estimated by the Company, and if the same provision were made for renewals and reserves. But the Committee point to the difficulty by comparing the Company's proposals with those of the Highways Committee. The scheme of the latter includes an area over which the Council have no financial control; and the wider area would, they say, necessitate more capital, while all the risks would fall entirely on the ratepayers of the County of London.

Other weak points of the proposals are dealt with at great length, and the conclusions arrived at are fully set forth. "We feel it our duty," say the Committee, "to state to the Council that we view with apprehension the large addition to the Council's capital commitments which this undertaking would necessarily involve. We desire to impress upon the Council the fact that, however good its credit may be, if it were to force larger loans on the market than the investing public could readily absorb, the Council would inevitably have to be content with a lower price for its issues of stock; and this would particularly be the case when the general conditions of the Money Market are not altogether favourable for such issues. The Committee consider that the time has arrived when the Council must, in their judgment, select from the objects of expenditure which they are being pressed to undertake, those which are necessitated by their present statutory duties, in order that their general financial position may not be prejudiced. They are, moreover, of opinion that the Council should be further guided in this matter by their financial position; and that they should not largely extend their financial engagements during the next few years beyond those already entered into.

Mr. P. H. Harris has given notice of his intention, on the recommendation of the Highways Committee to promote a Bill, to move the following amendment: "That the recommendation be referred back to the Committee, with an instruction that the Council are unwilling to promote a Bill relative to the supply of electrical energy in London which is not based upon any definite scheme, or upon any agreement with the Borough Councils or existing companies, or upon any estimates which would enable the Council to judge of the financial responsibilities to be incurred by the ratepayers; and, further, that it be an instruction to the Committee to consider the whole matter, and, in particular, to report whether, in view of the heavy commitments of the Council and the speculative nature of the proposed enterprise, the Council's efforts should not be directed to securing the supply of electrical energy by new or existing undertakings on terms and conditions which would safeguard the public interests."

WESTON-SUPER-MARE COUNCIL AND THE GAS-WORKS.

A Meeting of a Committee of the Weston-super-Mare Urban District Council was held last Tuesday to take into consideration, and report to the Council upon, the following subject: "Reports of the Finance Committee as to the desirability or otherwise of promoting a Bill in the next session of Parliament for the purchase by the Council of the undertaking of the Weston-super-Mare Gaslight Company." The reports of the Finance Committee, dated the 26th and 31st of October, were read. At the meeting on the latter date, a reply was received from the Gas Company, stating that the Directors had resolved that the Company were unwilling vendors, and were not prepared to name any price for their undertaking. If the Council obtained compulsory powers of purchase, the price would have to be determined by arbitration, in accordance with the provisions of the Lands Clauses Acts having reference to the purchase and taking of lands otherwise than by agreement, and subject to the provisions contained in subsections 3 and 4 of section 57 of the Weston-super-Mare Gas Act, 1901. A letter was read from Mr. T. W. Warry, the Manager of Stuckey's Banking Company, Limited, in which he stated the effect of the further opinion they had received from their London brokers relative to the question of floating a loan for the possible purchase of the gas undertaking. It was thereupon unanimously resolved: "That this Committee, as the result of their investigations, are unable to recommend to the Council the desirability of promoting a Bill in the ensuing session of Parliament for the purchase of the undertaking of the Weston-super-Mare Gas Company." A long discussion ensued, and a motion was submitted that the reports of the Finance Committee should be approved and adopted. Thereupon an amendment was proposed that the meeting should be adjourned in order to obtain the advice of a financial expert on the subject, and that on receipt of such report a meeting of the Council should be called at the earliest date. The amendment was carried by 9 votes to 5. This decision was confirmed at a subsequent meeting of the Council.

THE WILLEY MEMORIAL AT EXETER.

Tablet Unveiled at the Manual School.

On Monday afternoon last week, the Mayor of Exeter (Mr. E. C. Perry) unveiled a memorial tablet in the Royal Albert Memorial College, Exeter, to the memory of the late Mr. Henry Alfred Willey. There was a large attendance, including the Mayoress, Mrs. Willey, Miss and Master Willey, the Sheriff and the Town Clerk of Exeter, and Sir Edgar Vincent, M.P. The tablet, which is of white marble, was designed by Miss R. Tupman, one of the teachers at the School of Art, and executed by Mr. Herbert Read, of St. Sidwell's Art Works, Exeter. It is erected on the main staircase, and bears the City Arms, and the following inscription in brass letters: "This tablet was erected as a Memorial to Henry Alfred Willey, to commemorate his work in Founding and Equipping the Manual School, and in grateful remembrance of his Benefactions to this College and his good work for Education. Born 1863; died 1904." Mr. Depree, in presenting the tablet and asking the Mayor to unveil it, explained that it was only a portion of the memorial which the city had raised to the memory of the late Mr. Willey. Scholarships had been founded to carry on the idea which the late Mr. Willey had in view when he formulated them for technical training. The memorial was the work of pupils of the School of Art, and the centre-piece had been cast at Mr. Willey's works. The Mayor said that the Royal Albert Memorial College was indeed a fitting place for a memorial to so distinguished a son of Exeter as Mr. Willey, because his interest in that institution was very great. His enthusiastic work in connection with the establishment of the Manual School was quite well known to everyone. Mr. Willey spared neither time nor money to endeavour to secure all the latest methods that could be devised for the manual and industrial training of the great masses of the people; and by the erection and equipment, at his own expense, of the Manual School in their midst, he not only founded a most excellent institution, but one which he felt confident was only the progenitor of many similar institutions that would yet be founded in the British Isles. Mr. Willey held that our competitors for the trade of the world were devoting more time, more energy, more thought, and more means to manual training than we were; and, being stirred, he set himself to work to see what could be done on the lines

he had thought out after careful investigation. He (the Mayor) trusted that ere long a permanent building worthy of their Manual School, worthy of the idea that was contained in it, and worthy of the man who originated it, would be erected in the city. The School would be a standing monument to the public spirit of Mr. Henry Alfred Willey, who had left a deep impression upon the life of the City of Exeter. His Worship then accepted and unveiled the tablet. Sir Edgar Vincent proposed a vote of thanks to the Mayor, as well as to the designer, sculptor, and secretaries. Mr. Willey, he said, was one of the most remarkable men produced of late years in the West of England; and they all wished that the city of Exeter would produce many more of the same stamp. The Sheriff of Exeter seconded the proposition, and it was cordially adopted.

HUDDERSFIELD GAS, ELECTRICITY, & WATER SUPPLY.

Progress in the Past Financial Year.

Among the addresses delivered last Thursday by the Mayors in various parts of the country, was one by Alderman Benjamin Broadbent, who had been re-elected at Huddersfield. In the course of his speech, he made the following remarks on the gas, electricity, and water undertakings.

The gas undertaking continues to record eminently satisfactory results; thereby maintaining its position as the largest profit-earning department of the Corporation. For the year ending March last, the income from all sources amounted to £101,620. The gross trading profit was £30,670, or 9½ per cent. upon the whole capital expended. The profit was allocated as follows:—

Interest on loans, debts, &c.	£12,767
Contribution to consolidated loans and sinking fund .	1,795
Reduction of the debt upon reconstruction of works .	9,745
Depreciation and contingencies fund	6,453
Total	£30,760

It will be noticed that the Committee have added a further £6453, being 2 per cent. upon the capital account, towards the depreciation and contingencies fund, which was recommended last year, and now amounts to £12,906. The debt upon the reconstruction of works account of £96,392 has been reduced to £7194, which it is hoped will be speedily disposed of. The Gas Department is by far the largest contributor to the rates; and it is worthy of notice that the amount paid this year for borough rate was £4730, or about 1-33rd of the whole amount produced by the rate. The capital account remains at £322,655; and the amount accumulated towards its redemption is £77,407, or 24 per cent. The increase in the quantity of gas sold during the year was nearly 3 per cent. The sum collected through the prepayment meter system during the year was £18,080. At the last meeting of the Committee, the Engineer (Mr. E. A. Harman, M.Inst. C.E.) reported that there were at present 12,155 of these meters in use, which is sufficient proof of their usefulness and popularity. The total number of gas consumers is 25,300; being an increase of more than 1100 on the year. There is still an enormous demand for gas cookers, fires, and wash-boilers; showing a growing appreciation of their utility and efficiency. The number of gas-engines in use in the town is steadily increasing; and on account of their small working cost, their more general adoption may with certainty be anticipated. The most important feature is that the Committee have been enabled to make considerable reduction in the charges for gas to all classes of consumers from the 1st of January next, as follows: For lighting, from 2s. 9d. to 2s. 6d. per 1000 cubic feet; stoves and motive power, from 2s. 3d. to 2s. 1d. per 1000 cubic feet, less 5 per cent. discount for payment within one month. Prepayment meter consumers are to have returned 1d. for every shilling put into the meter, which represents a reduction in price from 30 cubic feet to 33 cubic feet for 1d. These reductions, while being a benefit to the consumers, will, the Committee believe, increase the output of gas, especially for manufacturing purposes.

The annual statement of the Electricity Department for the year ending Dec. 31, 1904, showed a surplus balance of £3875 5s.; and the sum of £2110 11s. 6d. was taken from the depreciation fund to enable the department to repay to the borough fund the amount of £5985 16s. 6d. which had been provided by the ratepayers to meet deficiencies during the first three years' working of the undertaking. The capital expended upon the department at the end of last year was £175,972 16s. 8d. There has been repaid and contributed to the sinking fund for the repayment of capital the sum of £38,530 13s. 2d.; leaving a balance of capital to be repaid of £137,442 3s. 6d. There is in addition the sum of £9743 in the depreciation and contingencies account. During the present year there have been 197 additional consumers connected, with 12,758 8-candle power lamps. This brings the total number of consumers to 2196, with 150,401 lamps connected. Owing to the increased output, the conditions of working are steadily improving. In 1894, the capital expended equalled £3 per 8-candle lamp connected; at the end of last year it was only £1 5s. 1d. In July, the price of energy for lighting purposes was reduced from 4½d. to 4d. per unit. This will represent a loss in revenue of about £2400 per annum, in addition to the loss of about £800 due to the reduction of meter-rents.

In the Water Department, the impounding and service reservoirs have been kept in good order. The filter-beds at the Deerhill reservoir and the settling-tanks at the Butterley reservoir continue to work satisfactorily. The eastern wing trench at the Butterley reservoir was completed on the 16th of May; and the western wing trench is now well in hand, under the supervision of the Engineers, Messrs. G. H. Hill and Sons. The embankment of the Longwood lower reservoir has been severed for the purpose of putting in new and larger outlet-pipes. The quantity of water in store at Blackmoorfoot is 416 million gallons, compared with 317 million gallons at this time last year. The renewal of mains during the year has been 452 yards, compared with 1470 yards last year; and the extension of mains, 7625 yards, compared with 3155 yards last year. The total length of mains is about 294 miles 1441 yards. The number of gallons of water supplied through meters for the past year was: Inside the borough, 427,579,000 gallons; outside, 93,929,000 gallons—total, 521,508,000 gallons, compared with 454,744,000 gallons before; thus showing an increase for trade purposes of 66,746,000 gallons. The population supplied was: Inside the borough, 101,736; and outside, 39,580—total, 141,316, compared with 138,753. The population is based on the number of houses supplied, reckoning 4·25 persons to a house. The number of houses added during the year was: Inside the borough, 384; and outside, 219—total, 603, compared with 494 in the years 1903-4. The number of meters fixed was: Inside the borough, 595; outside, 209—total, 804, compared with 808 before.

METROPOLITAN WATER BOARD.

The Proposed Uniform Scale of Charges for Water.

The Ordinary Meeting of the Board was held on Friday—Sir R. M. Beachcroft in the chair. The Works and Stores Committee submitted a report in regard to the proposed new works in the Lea Valley; and, on their recommendation, it was agreed that a Bill relative to these works should be promoted next session. The question as to the contribution by the Local Authorities towards the cost of treating the sewage in the Lea Valley district in connection with the new works was adjourned. The amended cost of the proposed new works was estimated at £685,000; it having been decided, on the advice of the Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.), to abandon the proposed reservoir near Feilde's Weir, the estimate for which was put at £290,000. With reference to the question of a uniform scale of charges, the Law and Parliamentary Committee reported that a Special Committee, consisting of the Appeal and Assessment Committee and representatives of the other Committees of the Board, had for some time been engaged in the consideration of the general question of the adoption of uniform scales of charge; but they had now received a memorandum from the Special Committee, forwarding a copy of a report of a Sub-Committee, in which it was stated that, though the necessary financial details were in a forward state of preparation, it had been found impracticable to finish them yet; that, in fact, some further time must necessarily elapse before the returns could be completed, and that, in consequence, it was at present impossible to elaborate a scheme for the Board's consideration. In these circumstances, the proposed Bill could not be deposited in December.

LEEDS AND THE COLSTERDALE RESERVOIR.

The Colsterdale reservoir contract was once more before the Leeds City Council last Thursday, when Mr. J. H. Armitage, the Chairman of the Water Committee, moved the rescission of a resolution passed in April letting the contract for the work to Messrs. R. M'Alpine and Son. He explained that at the meeting at which the tender was accepted, Mr. Henzell, the new Water-Works Engineer, was appointed. Prior to the meeting of the Council to confirm the resolution of the Water Committee, Mr. Henzell, at the request of the Chairman, visited the site of the reservoir, and came to the conclusion that in all probability some alterations would have to be made in the plans; but this could only be definitely ascertained by a complete and exhaustive examination of the strata of the site and the plans themselves. These investigations involved the sinking of numerous trial holes, in order to ascertain the nature of the subsoil of the site of the proposed bank; and the Engineer now reported that the site suggested was not suitable. Up to the present, he was not in a position to advise where the bank should be placed; but he was pursuing his investigations further. This, of course, entirely altered the essential features of the contract. The nature of the work would have to depend upon the character of the site chosen. The effect of the alterations which would be necessary might probably be to reduce the size of the reservoir; and, if so, it would be necessary to go to Parliament to obtain some modification of the obligations of the Corporation as to compensation water. These facts having been carefully considered by the Town Clerk, with the assistance of Counsel, their emphatic advice was that the Council had now no alternative but to rescind the resolution of April. This was agreed to without discussion.

A Proposed Wayleave for Gas-Mains.—The St. Austell Gas Company have submitted their draft Order to the Highways Committee of the Cornwall County Council, and asked the sanction of the Council to enable them to deal with the main roads. The Clerk was instructed to state that the Committee would approve of the Order on the Company entering into an annual agreement, with regard to the gas-mains, not to break the surface of the roads without consent, and to give notice of their intention, both for existing and future mains and new connections, and to pay an acknowledgment of £1 per mile, or part of a mile, of main pipes on the roads to whose maintenance the county contributes.

Gas v. Electricity for Workhouse Lighting.—The Borough Electrical Engineer for Islington (Mr. Albert Gay) has submitted the terms on which the Guardians could have electric lighting and power. The Committee of the Cornwallis Road Workhouse reported on Wednesday against any change being made. They said they had come to this decision from figures which had been submitted by the officials, from which it appears that the average cost of gas for the past three years had been £345 per annum; the number of burners throughout the building being 581. It was estimated that if electricity were used the number of lights required of 16-candle power would be 278, and 264 of half this power. On this basis, the consumption of electricity would amount to 27,000 units per annum, which at 4d. per unit would come to £450. The Committees having supervision of the other buildings also reported against the acceptance of Mr. Gay's terms.

PROTECTION OF WELSH WATER AREAS.

Conference of the Glamorganshire Local Authorities.

The question of protecting the water areas of Wales formed the subject of discussion at a largely attended meeting of representatives of sanitary authorities of Glamorganshire held at Neath last Wednesday, when Mr. J. B. Jenkins, Chairman of the Glamorganshire County Council presided.

Alderman T. J. Hughes, introducing the subject to the meeting, urged the paramount importance of the county having an ample supply of pure water. He recalled the fact that Lord Swansea, when he was Chairman of the Council, had first brought the matter forward; but it was not until the London County Council applied for parliamentary power to acquire gathering-ground in Radnorshire and Breconshire that it came to a head. The Bill had been dropped; but they never knew when the project might be brought forward again. The population of Glamorganshire had increased from 467,954 in 1891 to 601,092 in 1901. Ten years hence, at the present rate of increase, it would reach 770,000. To this had to be added the city of Cardiff and the county borough of Swansea; and it was estimated that fifteen years hence there would be a deficiency of at least 10 million gallons per day, after all the existing and available sources in the county had been utilized. Manchester and Birmingham drew their supplies from Wales; but there yet remained 1500 square miles of land forming a splendid gathering-ground, and it behoved the county to see that their interests in it were safeguarded for future eventualities. The suggestion was that Parliament should be approached to pass a Bill similar to the Act which created the Derwent Valley Water Board.

Mr. Nicholas, the Clerk to the Rhondda District Council, said they were already carrying out an important water scheme; and he asked if it was proposed to deal with districts that already had systems of water supply.

The Chairman replied that all they wanted was to protect themselves against being shut off from water supplies.

Mr. Nicholas asked the Clerk to the County Council if he considered that Parliament would sanction the creation of a Board having no definite object beyond the protection of water interests. The Clerk (Mr. T. M. Franklin) said he thought so, provided the County Council had the support of the sanitary authorities of the county. A long discussion followed, in the course of which it transpired that none of the delegates had plenary powers. It was eventually decided that they should recommend their Councils to support the promotion of a Bill for the creation of a Water Board for Glamorganshire for protective purposes. It was pointed out by the Clerk that, as it was not proposed to include any other county or portion of a county, it would be needless to create an entirely new Water Board; and he suggested that the meeting should agree to the County Council acting in this capacity. This idea was unanimously adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The action inaugurated by Mr. W. R. Herring, of Edinburgh, with reference to the proposed regulations regarding traffic upon private railway sidings, has been followed up by him with great promptitude. Realizing that the time was short, if concerted action was to be taken, he called a meeting of gas managers in Scotland of works producing 50 million cubic feet of gas a year, to consider the subject. A very gratifying response was made to his invitation—as many as fifteen gentlemen, from a wide area of country, having assembled in the Board-room of the Edinburgh and Leith Gas Commissioners yesterday. Through the courtesy of the gentlemen who attended, I am able to send an official account of what took place. [It will be found on page 344.] It will be observed that a circular dealing with the subject is to be sent out to corporations and companies interested, and that another meeting is to be held in Edinburgh on Friday next, when the question of whether or not concerted action should be taken will be decided.

It is with regret that I announce that the promise which was held out in the beginning of July last that Preceptor R. M. Mitchell, who was for many years Convener of the Gas Committee of the Glasgow Town Council, should be elected Lord Provost of that city, has not been fulfilled. The other candidate was Mr. W. Bilsland. When there was an informal counting of heads in the Town Council at the end of June last, it was given out that Mr. Mitchell was assured of the office, irrespective of any results which might attend the elections in November. These elections are now over, and the expectation so confidently given has not been realized. According to custom, the Council met in private on Thursday—the second day after the election—to consider the filling up of vacancies. From this meeting there were several councillors absent; and when a vote was taken, it was found that 40 members favoured Mr. Bilsland, and 36 Mr. Mitchell.

Among other results of the municipal elections of this week to which I ought to refer, are the defeat of Sir Andrew M'Donald in the Newington Ward of Edinburgh; and the elevation of Mr. James Cuthbert, the Convener of the Gas Committee of that City, to be Lord Provost of Perth. Sir Andrew M'Donald was rejected by nearly 1000 votes. In official circles, where his abilities were known, there is much sympathy with him. The election of Lord Provost Cuthbert at Perth was carried through unanimously. He has been more than once Convener of the Gas Committee; and in this and other capacities he has done much good work for the citizens, which they appreciate.

Last night Mr. Robert Martin, the Manager of the Niddrie and Benhar Coal Company, Limited, delivered a lecture at Musselburgh, on the "History and Progress of Local Coal Mining," in the course of which he said that, according to the most recent computations, there were in the Edinburghshire portion of the Lothians, 5 billion tons of coal, which he considers is sufficient to last for 2000 years.

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INSETS,

We are sending out

RADIATORS

as fast as we can make them.

WRIGHT,
THE RADIATOR
PEOPLE.

Advertisement of John Wright & Co., Essex Works, Birmingham.

The Scottish Junior Gas Association was busy this afternoon, both Districts having engagements. The first in point of time was the Eastern District, who, at three o'clock, paid a visit to the Dunfermline Corporation Gas-Works, where they saw the wonderful coal and coke handling plant, which is the special design of Mr. A. Waddell, the Engineer and Manager there. This, and the numerous other highly ingenious devices, some of them patented, which Mr. Waddell has been able to apply to his business of making gas, were closely inspected with much interest, even curiosity; the coal-handling plant coming as a surprise to many, on account of its completeness at every point, and withal its simplicity. The apparatus was seen at its worst, as the day was dark and dismal; but, working under the most difficult of conditions, the plant, in careful hands, moved without a hitch. It is almost needless to say that everyone was highly gratified with his visit. Then, at half-past seven in the evening, the Western District held a monthly meeting for the reading and discussion of papers, of which there were two. Mr. James Simpson, the Coal Inspector for the Corporation of Glasgow, gave the first, on "Coal and Coal Mining." It was a chatty paper, full of reminiscence, but avoiding the thorny subjects of the composition or the varieties, analytically, of coal, with the consequent problems of which varieties are best suited for gas making. The other paper submitted was by Mr. T. M. Moir, of Perth, and was upon "Gas-Works Bookkeeping." Mr. Moir adopted a very general line of treatment; contenting himself with setting forth the books which he considered should be kept in the works, with a few hints as to the entries to be made in them, and leaving out of account all the books relating to finances, as well as those in which balances showing the results of working might be brought out. He had a wide-enough field before him, and filled it to the satisfaction of most of the members who took part in the discussion, which was brief, probably on account of nothing contentious having been introduced.

I was at Alloa on Thursday afternoon, at the formal inauguration of the De Brouwer charging plant, which Mr. J. W. Napier, the Engineer and Manager of the Corporation Gas and Electricity Departments of that burgh, has introduced into the gas-works. Being the first installation of the kind in Scotland, it was the first I had seen, and I therefore looked at it with the greater interest. It impressed me very much, on account of the small space it occupies, its adaptability to any form of horizontal retort-settings, the speed and efficiency with which it does its work, and the absence of noise. [An illustrated description of the machine will be found on page 457.]

This week I have to record the death of two retired Gas Managers in Scotland—that of Mr. James Black, late Manager at Newport (Fife), which took place on Tuesday, and of Mr. James Gemlow, late Manager at Cupar-Fife, which took place at Arbroath on Thursday. Both were aged men, and did good work in their day.

Yesterday afternoon a violent explosion of gas took place in a dwelling house in Alfred Terrace, Great Western Road, Glasgow. The glass panels in the front door were blown out, and nearly all the windows at the back of the house were shattered; and a small conservatory built against the back wall of the house was wrecked. One of the servants was badly burned, and the other inmates of the house suffered from shock.

An explosion of gas took place in the office of the Imperial Granite Works, St. Clair Street, Aberdeen, on Tuesday. A back room was found to be full of gas, and on Mr. A. Milne, the occupier, lighting a match to endeavour to find out where the escape was, a terrific explosion occurred, the noise of which brought a crowd of several thousand persons to the place. All the windows were blown out, the doors were wrenched from their hinges, and an adjoining wall was thrown down. The interior of the office and the furniture were also badly damaged. Mr. Milne and his lady clerk were stunned by the force of the explosion, and sustained considerable injuries. The damage is estimated at between £30 and £40.

CURRENT SALES OF GAS PRODUCTS.

Week ending Nov. 11.

In London, the value of tar products has been firmly maintained, although transactions have not been numerous, in consequence of the makers being well sold. It appears that 36s. net is the lowest price asked for pitch between now and June next. Deliveries of this article are being readily taken up, in some cases in advance; and it is anticipated that, so soon as steamers are obtainable at reasonable freights, shipments will be even brisker, and the normal stocks will probably disappear. Toluol and solvent naphtha are still in active demand, but scarce for early delivery; while holders are not inclined to sell for forward. There is not quite so much inquiry for benzols and 60's proved carbolic acid as recently; but prices are unchanged. The best makes of ordinary London creosote are unobtainable at less than 2 1/16d. to 2 1/4d. net; while the demand is far in excess of the visible supply. There has been rather more interest evinced in sulphate of ammonia during the week; and the quotations remain at £12 17s. 6d. to £13 on Beckton terms for November delivery.

Sulphate of Ammonia. LIVERPOOL, *Nov.* 11.

Weakness has pervaded the market at all points, and a further decline in values has to be recorded; the closing prices being £12 10s. per ton f.o.b. Hull, £12 12s. 6d. per ton f.o.b. Liverpool, and £12 13s. 9d. per ton f.o.b. Leith. There has been more eagerness on the part of the smaller makers to market their output, and more reselling, without any special demand from any quarter. Probably the easier forward market has reflected prejudicially upon the spot position in the way of keeping buyers off. Makers still maintain a firm attitude for delivery ahead, and no important first-hand business has been reported. There has been good inquiry for the first four months of

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1906, and a fair amount of business has been done abroad at prices not much above the reduced spot level; but the orders have been taken speculatively.

Nitrate of Soda.

This article is neglected in all positions, but without much alteration in quotations. On spot the prices are 10s. 9d. and 11s. per cwt., according to quality.

LONDON, *Nov.* 11.

Tar Products.

There has been a fairly good business doing during the past week, although, as a general rule, the demand has not been quite so strong for forward delivery. In benzol, 90 per cent. is quiet, and there are now sellers at 10¾d. London for both prompt and forward delivery. In 50-90 per cent., there is a decided improvement; doubtless owing to the fact that one of the largest foreign consumers is reported to have purchased a considerable quantity at about 10¾d. for delivery over the first six months of next year. The scarcity of toluol should certainly have the effect of improving the market for this quality. Toluol is very scarce indeed, and it is difficult to fix the actual value. The last business done was at 11¾d. f.o.b. London for early delivery; but makers at present decline to offer forward. Solvent naphtha is still very firm; and so far as London is concerned, there is little or nothing offering for prompt delivery. Sales are reported to have been made at 11d. during the past week for ordinary 90 per cent. at 160° for November-December delivery; while in one instance slightly over this figure was paid for a small quantity for prompt. In carbolic acid, prices have been fairly well maintained during the past week, and there appears to have been a large business done at about 1s. 9½d. for both prompt and forward delivery. In crystals, the French Government contract is reported to have been divided among various makers; and the prices accepted in some instances were very reasonable indeed. The market continues very firm in creosote, and there is, as a rule, no alteration in the value. The demand from America is still good for salty oil for both prompt and forward delivery. In pitch, the market continues strong, but there has not been quite so much business doing. London makers still maintain their quotations; but buyers decline to pay anything over 35s. at present. There is rather more offering in the Yorkshire district; but, as a rule, makers ask 35s. 6d. At this price, however, business is not possible, and it is reported that small sales were made at under this figure; but there are no transactions of importance to report. There are still considerable inquiries from the Continent; but makers' ideas of value prevent consumers purchasing just at the present time, though one or two contracts are reported to have been placed in the South Wales district for delivery up to June next year.

Average values during the week were: Tar, 18s. to 22s. 6d. Pitch, London, 35s. to 35s. 6d.; east coast, 34s. 6d. to 35s.; west coast, 32s. to 34s. Benzol, 90 per cent., 10¾d.; 50-90 per cent., 10d. to 10¼d. Toluol, 11d. to 11½d. Crude naphtha, 3¾d. to 4d.; solvent naphtha, 10¾d. to 11d.; heavy naphtha, 10½d. to 11⅛d. Creosote, London, 1⅞d. to 2d.; North, 1⅜d. to 1½d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9¼d. to 1s. 9½d. Refined naphthalene, £4 10s. to £8; salts, 15s. to 17s. 6d. Anthracene, "A" quality, 1½d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market is decidedly quiet, and prices are certainly easier. Beckton's nominal price is still £12 17s. 6d.; but there are second-hand sellers on Beckton terms at about £12 15s. In Hull, manufacturers ask £11 12s. 3d.; but buyers are not open to pay more than £12 10s. for November-December, while makers are not prepared to entertain business further forward at present. The position in Leith is unchanged; but there is certainly not so much demand. £12 16s. 3d. is reported to have been accepted in more than one instance; but at present buyers are not prepared to pay more than £12 15s. for November-December. In Liverpool the market is quiet, and the value may be taken as about £12 15s. for November-December.

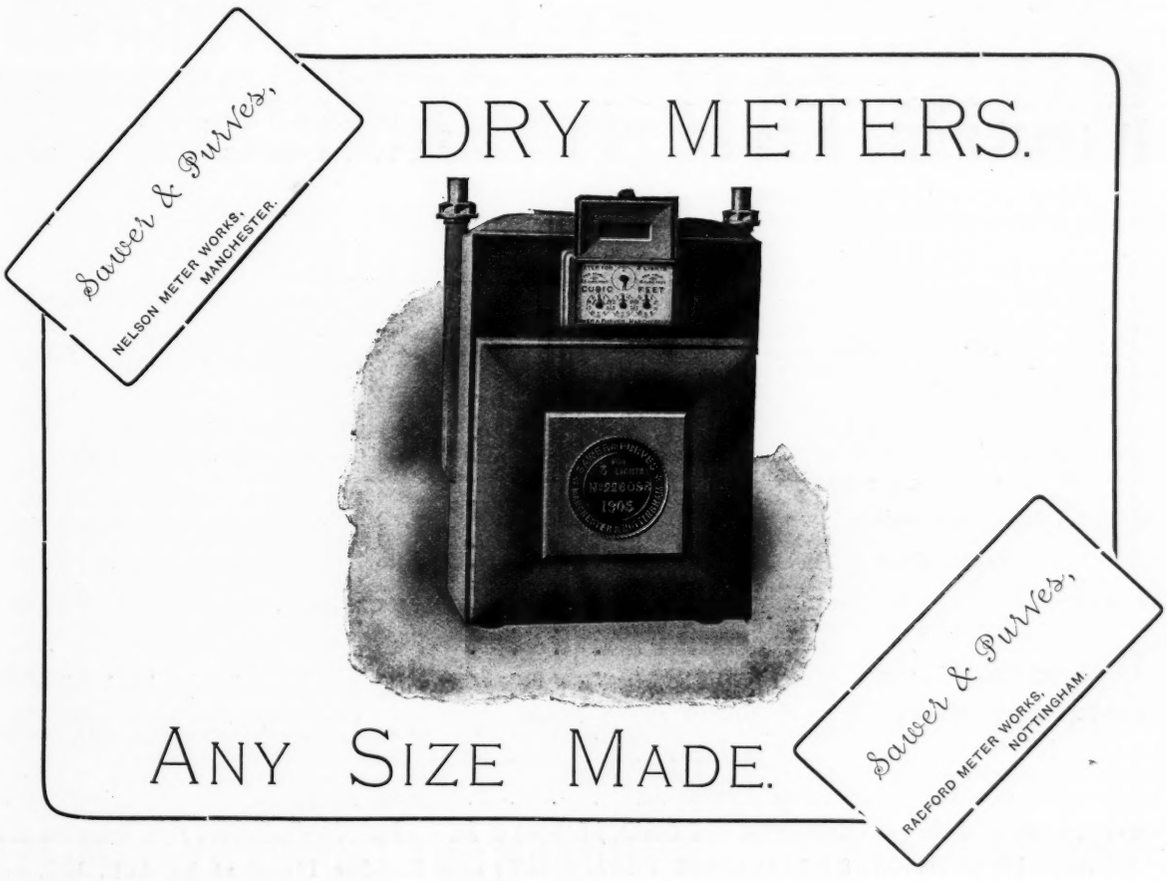
COAL TRADE REPORTS.

Lancashire Coal Trade.

The vagaries of the weather are supposed to be the factors which affect the rise and fall of the demand for house coal, and certainly we do not know to what other cause there can be any serious contributory influence. The fact is that while this department is better in tone than for months past, there is not that briskness which sellers at any rate had been led to expect. Prices are practically unchanged. Engine fuel remains firm; and prices for slack and burgy are well maintained. More furnaces being brought into use, the demand for coke is improving, with the result that prices are hardening. Cannel finds more inquirers, and sales are increasing. One Manchester firm has just received an order for 500 tons of cannel, which is being shipped at the Salford docks for delivery elsewhere. Rather more coal is going out for use in iron furnaces. The shipping trade generally is on the mend. The total quantity of coal shipped at Manchester is not of very large dimensions. The bulk finds its way from Wigan, Tyldesley, Atherton, and that district of the county to the tips at Partington, Garston, and Cadishead. The average quotations at the pits are: Best house coal 13s. to 14s., secondary 12s. to 13s., common 9s. to 10s., steam and forge 8s. to 9s., best engine fuel, 7s. 6d. to 8s. 6d., slack 7s. to 8s., medium 6s. 6d. to 7s. 6d, common 5s. to 6s., washed slack 7s. 6d. to 8s. 6d., and coal for shipping on the Manchester Canal 9s. 6d. to 10s. 6d.

Northern Coal Trade.

The changeable weather is influencing the coal trade, both by checking the shipments, and, in some measure, varying the consumption. In the steam coal trade, best Northumbrians are about 8s. 7½d. per ton f.o.b., with a slower demand. Second-class steams are 8s. 1½d. to 8s. 3d.



per ton, and steam smalls are quiet at 4s. 6d. to 5s. 6d.—the work at the collieries being less, and tending to make small steams more scarce. There is no change of moment in the manufacturing or bunker coal trades; but the better demand for gas coals throws less Durham fuel into the two markets just named. Gas coals are now in very heavy demand; but the inclement weather has once or twice checked the dispatches. The quantities that are sent to the great Southern Companies are now at about the maximum; and thus there is not so much coal beyond these free for sale. Occasional cargoes are sold at from 8s. 3d. to 9s. 4½d. per ton f.o.b., according to the quality; and best Durhams seem at the present time to be most in demand, and therefore firmest in price. The local consumption of gas coals is also heavy. Coke is firm for export, and very firm for furnace use; but gas coke is dull—the output being very high, and the shipments poor. F.o.b. quotations for good gas coke vary much—from 10s. 6d. to 11s. 6d. being current figures; but the values are very irregular.

Scotch Coal Trade.

The strength of the coal market is well maintained. A large volume of business is being placed for home consumption; and, it is said, home consumers are endeavouring to buy their supplies as far forward as possible. Splint coal is in good demand, and it is expected that it will go higher in price now that the requirements for gas purposes make the supplies in the market shorter. The prices quoted are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 3d. to 9s. 3d., and splint 9s. 6d. to 9s. 9d. The shipments for the week amounted to 260,941 tons—a decrease of 16,583 tons upon the preceding week, but an increase of 34,774 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,477,748 tons—an increase of 555,054 tons upon 1904.

Reduction in Price.—The Directors of the Wandsworth and Putney Gas Company have reduced the price of gas from 2s. 2d. to 2s. per 1000 cubic feet from the taking of the meter indices at the Christmas quarter.

New Mills Water-Works Purchase.—The New Mills Urban District Council have decided to purchase the water-works from which the town obtains its supply. These are the property of a Mr. Sumner, who is to receive for them £11,000. The works comprise about 7 miles of mains, four reservoirs, with a storage capacity of about 3 million gallons, and a turbine in the Goyt Valley. Mr. Sumner supplies the district with water under a Special Act of Parliament passed in 1831; but there are about 330 houses not supplied at all, and 420 in Newtown that are supplied by the Stockport Corporation. There is a flow of water of 500,000 gallons a day down Jow Hole tunnel, which Mr. Sumner has on lease for an unexpired term of 14 years. This water belongs to the Duchy of Lancaster; but the Council have agreed to purchase the rights for £300. A clause in the Stockport Corporation Water Act gives the New Mills Council the right to purchase the Corporation mains in Newtown at a valuation.

The Lighting of Devonport.

A Committee which was recently appointed to consider the public lighting of Devonport presented to the Council last Thursday a report with reference to those streets in which the question of electric lighting may arise. The Gas Engineer (Mr. J. W. Buckley) reported to the Committee that the present charge for 15-candle power lamps was £3 7s. 6d. per annum, and that the cost of converting these lamps to incandescent would be 10s. 6d. each, and the charge for lighting £3 12s. 6d. per annum. There are 1032 lamps in the borough, of which 332 are incandescents; and the Gas Engineer pointed out that the same quantity of gas is consumed by the ordinary burners giving a light of 15 candles as by incandescent burners giving 100-candle power. If all the ordinary burners were converted into incandescent gas-lamps, the extra annual cost would be £175. The Gas Committee offered to bear the cost of converting the present lamps for incandescent lighting; and the Committee recommended that incandescent gas lighting be adopted in all the streets in the borough other than those where electric cables are laid, and that the work be carried out without delay. The Committee also reported that the Gas Engineer had been instructed to put up certain gas-lamps so that a comparison might be made with electric flame arc lamps erected by the Electric Lighting Committee. Alderman Waycott remarked that the Lighting Committee were able to make some progress. They recommended that incandescent gas lighting be adopted throughout the borough where there was no question of the electric light coming in. For the moment the matter of electric light *v.* gas would be in abeyance; but the Gas Engineer had in preparation a report on the comparative cost of the two systems. It was hoped this would be submitted at the next meeting of the Council or the meeting in January. The Committee's present recommendations were adopted after some discussion.

Breaking into the Stockport Water-Works Office.—At the Stockport Police Court, two men named Rogers and Owen have been sent to prison for two months for stealing nearly £2 in money and stamps from the water-works office. Between the 28th and 29th ult., the prisoners broke in and forced some drawers open. The stamps were found at the place where Rogers lived. Both prisoners pleaded guilty, and urged that want had led them to commit the crime.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards offered for sale, under instructions from the Directors, £20,000 of new ordinary "B" stock of the Southend Gas Company; ranking for a standard dividend of 5 per cent. per annum, subject to the sliding-scale; the last dividend having been at the rate of £5 7s. 6d. per cent. It was sold at prices ranging from £107 to £108 5s., or an average of £107 10s. per £100 of stock. With reference to the sale by tender of £10,000 of the Reading Gas Company's ordinary stock, noticed last week, the applications really amounted to upwards of £44,000; and the stock was allotted at considerably higher premiums than had before been obtained for it.

CARBURETTED WATER-GAS APPARATUS

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.	1,800,000
		ACCRINGTON	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND, IN ADDITION, 8,150,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

Municipalities in Search of Light.

Under the above heading, the "Yorkshire Observer" says Belfast is at present in a dilemma as to the best method of improving the street lighting of the City; and one result is a very pleasant month's tour in England for a deputation, who will include Leeds and Bradford in their itinerary. They have arrived in Glasgow; and the other cities to be visited are Edinburgh, Dundee, Newcastle-on-Tyne, Manchester, Liverpool, and London. Their precise object is to ascertain the most suitable method of lighting the streets and the City Hall Square with electricity; utilizing the supply provided for the new electric tramway service. But it is more than probable that they will return with still uncertain, if not mystified, minds. Take their visit to Leeds and Bradford, for instance. In the former city they will find electric lighting in high favour, and will be shown long lines of arc lamps which have recently displaced gas-burners. In Bradford, however, they will learn that the newer illuminant is altogether at a discount, and that incandescent gas lighting is regarded as the most satisfactory method, not only from an illuminating, but also from a financial, point of view. But prior to all this, they will discover that the Newcastle authorities have not yet made up their minds on a question which is more or less a matter of controversy in every important town in the country. In Newcastle, the Gas Company present a case which naturally shows that their lamps have many advantages over electricity; and, on the other hand, the Manager of the Corporation Tramways, in a report issued a few days ago, contends that, so far as illuminating power goes, arc lamps are fairly constant, while incandescent gas-lamps vary considerably according to the condition in which the mantles are maintained.

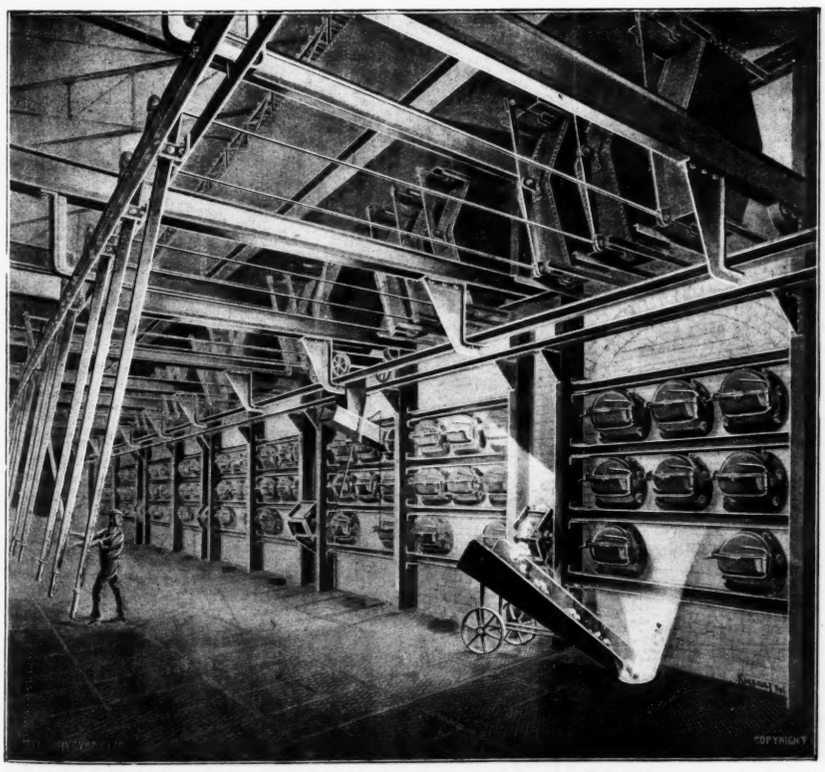
Electricity v. Gas at Malton.

We learn from a local correspondent that the Northern Counties Electricity Company have now nearly completed the fitting of their plant for lighting the whole of the area of the Malton Urban District Council; and that all the members of the latter body seem to be anything but pleased with the result. The main streets of the town have now been lighted electrically for some weeks, and there is almost general complaint of the bad light, as compared with that given by the incandescent lamps previously used by the Malton Gas Company. The contrast between the lighting of Malton and the neighbouring town of Norton is most striking. Up to the present, the Malton Gas Company retain the contract for lighting Norton; but it expires in August next, and already the Electricity Company are on the alert. Soon after obtaining an Order from the Board of Trade for lighting Malton, they secured a similar Order for Norton; and, at a meeting of the Norton Council on Monday night last week, permission was given to the electricity people to lay their main cable from Malton through the Council's property to Norton. The Council had consented to the abrogation of a clause in the Order under which the Electricity Company had agreed to construct a separate generating station for Norton; and some of the ratepayers in the latter place, having before them the poor specimen of lighting results at Malton, are protesting against the Council so readily throwing themselves into the arms of the Electricity Company. Our correspondent considers that, with the example before them of so many municipal and urban authorities in going back to gas lighting, the Norton Council would do well to pause and wait awhile, especially when they have the opportunity of seeing electric lighting tried by the sister town. The Norton authorities use gas power for pumping at the water-works; and we learn that the electricity people have promised to "do it for very much less." But, unfortunately, such promises are not always realized by actual performance, as the Malton people have already found to their cost.

Fatality at a Chemical Works.

As the result of being overcome by fumes at Messrs. Hardman and Holden's chemical works, Miles Platting, one man last week lost his life, while two others had to be removed to hospital. Early on Wednesday, Joseph Lilley, a carter, employed by Mr. R. Holt, was engaged in hoisting lime in a portion of the works. He did not resume the task after the breakfast half-hour; and another man, named George Lilley, made a search, and discovered him in an unconscious condition close to an uncovered drain in the vicinity of the sulphate yard. Even then fumes were quite perceptible; and before he had succeeded in obtaining assistance George Lilley himself was overpowered. A second man, named M'Donald, made an attempt to rescue his colleague, with the same result. When the men were rescued, it was at once apparent that Joseph Lilley's condition was the most serious; and attempts at artificial respiration were made, but unfortunately without success. At the inquest, the Manager (Mr. Coleman) explained the nature of the plant which passed through the yard. With the aid of a plan, the Jury were shown how a solution composed of steam, sulphuretted hydrogen, and carbonic oxide passed to a catch-tank, and then to the place where the gases were burned. Mr. Coleman said the steam was condensed and flowed into the tank from a main-pipe. The tank was in a corner of the sulphate yard; and it was not impossible that, in the event of extra pressure in the pipes, the gases would also escape at that point. About an hour before the accident, a wooden peg near to the tank had been blown out of the pipe; but it was replaced at once. After the mishap, witness said he found that a tap which allowed the separated gases to pass into a 4-inch pipe had been closed; and the effect of this was to produce extra pressure in the 2-inch pipe. The Jury returned a verdict of death from poisoning as a result of the gases. They added that, in their opinion, the taps of the plant should be enclosed so that no one but the foreman could get at them.

INCLINED RETORTS.



12 YEARS' Experience in actual building of Benches.

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No Gas-Works is complete unless the above are in use.

PATENT "DWARF" INCLINED BENCH.

Write for Estimates.

NEW CONVEYOR Co., Ltd., SMETHWICK.

Reduction in Price for Power at Newtownards.—The Newtownards Urban District Council have reduced the price of gas used for trade purposes (exclusive of lighting or heating) to 2s. 4d. per 1000 cubic feet, subject to the discounts at present in force. The concession is to take effect from Jan. 1 next. The price of gas to private consumers is 3s. 4d. per 1000 cubic feet.

Gas Managers as Municipal Councillors.—At the recent municipal elections, Mr. Thomas Duxbury, of Manchester, who offered himself as an Independent candidate at Darwen (West Central Ward), was successful; receiving 384 votes against the next highest candidate's 281—a majority of 103. Mr. Duxbury, it may be remembered, was formerly Engineer and Manager of the gas-works.

Gas v. Electricity at Port Elizabeth.—The Town Council of Port Elizabeth have lately issued a pamphlet dealing with the "Advantages of Electricity;" and it has afforded the Manager of the South African Lighting Association, Limited (Mr. William Arnott), an opportunity of demolishing some of the statements made therein, and of showing that the advantage is really on the side of gas. He was in the thick of the fray when the last advices came to hand.

An Open Gas-Tap at Liverpool.—Two visitors from Ireland have had a narrow escape from death in a Liverpool hotel, owing to a gas-tap in their bedroom having by some means been left open. Last Tuesday morning, a servant noticed a smell of gas; and, on entering the room, found the couple lying unconscious. Two constables rendered first aid; and the sufferers were then removed to the hospital, where they soon made progress towards recovery.

Cleethorpes Gas Suffocation Case.—At the inquiry into the circumstances attending the death of the little girl at Cleethorpes, to which reference was made last week (p. 408), a communication was received from the father, who could not be present, to the effect that he must have moved the gas-tap after having turned off the gas, and so caused the escape by which he and the child were overpowered. The Jury returned a verdict of "Accidental death."

Water Scarcity at Loughborough.—In spite of the recent rainfall, the scarcity of water at Loughborough remains; and extreme measures are being taken to husband the small supply that is still in the reservoirs. A certain quantity of water is being taken from an old well which has been opened up near the Nanpantan reservoir; but it will be two or three months yet before the new Blackbrook scheme will be advanced enough to permit of assistance from this source.

Improvement in the Water Outlook at Harrogate.—Owing to the decrease in the quantity in store, the Harrogate Corporation lately decided to curtail the supply of water; but copious falls of rain have since rendered this step unnecessary. Knaresborough will now be able to receive its full supply, without the necessity of pumping from the River Nidd, preparations for which were being made. During the rainfall the amount of water in the reservoirs increased from 40 to over 80 million gallons.

Cost of Opposing the South Suburban Gas Bill.—At the meeting of the Lambeth Borough Council, last Thursday, it was reported that the total expense of opposing the South Suburban Gas Company's Bill last session was £659 15s. 3d. This would be borne by the Borough Councils of Camberwell and Lambeth, and the Urban District Councils of Beckenham and Penge, in proportion to the rateable values of the respective areas served by the Company in each Authority's district. On this basis, Lambeth would pay £56 5s. 3d.

Cost of the Otley Gas Bill.—The cost incurred by the Otley Urban District Council in the promotion last session of the Bill which had for one of its objects the purchase of the gas-works, is returned at £1277; the repayment of which may be spread over a period of five years. It is calculated that this amount will represent a 2d. rate; but it is not intended to increase the rates of Otley for the purpose of paying off the charge, but rather to curtail expenditure in other directions. It will be remembered that the gas clauses were struck out as the result of an adverse vote on the scheme by the ratepayers.

Lighting of Kingsway.—At the meeting of Holborn Borough Council on Wednesday, the Works Committee reported that they had considered a letter from the Metropolitan Electric Supply Company, Limited, offering to erect and supply with energy, free of charge for six months, two arc lamps at the junction of Kingsway with High Holborn, and in Southampton Row opposite Fisher Street. Having regard to the fact that the Council had already decided on a system of high-pressure gas lighting for this thoroughfare, the Committee said they were not disposed to advise the Council to entertain the proposal; and they therefore recommended that the offer be declined with thanks. This was agreed to.

New Joint-Stock Companies.—The "Khoma" Gas Arc Lamp, Limited, is the title of a Company which has been registered with a capital of £1000, in £1 shares, to adopt an agreement with Mr. C. W. Harrison, and to carry on the business of gas lighting engineers and gas-lamp manufacturers. There will be no initial public issue. The Hall Lamp Company, Limited, has been registered with a capital of £2000, in £1 shares, to acquire, as from May 22 last, the business of a lamp manufacturer carried on by Mr. A. E. Mitton at George Street Parade, Birmingham, as Messrs. Mitton and Son and the Hall Lamp Company, and to carry on the business of lamp, lantern, and gas-fittings manufacturers, &c. There will be no initial public issue.

Newquay Gas and Water Supply.—The Newquay Urban District Council had under consideration last Tuesday an important proposal with reference to the gas and water supply of the district. Mr. North moved that a Bill be promoted in the ensuing session of Parliament to authorize the Council to purchase the undertaking of the Newquay and District Water Company, and to supply water throughout the urban district and the parishes of St. Columb Major, Colan, and St. Columb Minor, and also the undertaking of the Newquay Gas Company, Limited, and to supply gas throughout the urban district of Newquay and the parish of St. Columb Minor within the Company's limits of supply; and for other purposes. In the course of the discussion, Mr. Vivian said he understood that the Council did not intend to take over the gas and water supply at present. The resolution was carried.

PARKINSON'S

"VILLA"

GAS-FIRE.

No. 40

LANTERN.

WRITE—

PARKINSON AND W. & B. COWAN, LTD.

(PARKINSON BRANCH),

COTTAGE LANE, CITY ROAD, LONDON. | BELL BARN ROAD, BIRMINGHAM.

Manchester and the Chorlton-cum-Hardy Gas Supply.—There will be a special meeting of the Manchester City Council to-morrow, to consider (among others) a resolution authorizing the inclusion in the Manchester Corporation Bill, 1906, of clauses to confirm the transfer to the Corporation of the rights, powers, privileges, and property of the Stretford Gas Company within the district of Chorlton-cum-Hardy.

Stockport Water Supply.—In last week's issue we reproduced a paragraph from the "Contractors' Chronicle" which stated that grave difficulties had been encountered in the construction of a reservoir for the Stockport Corporation at Kinder Valley, Hayfield. Since then the Contractors have paid all the men off; and the works are consequently at a standstill. The principal trouble is the unsatisfactory nature of the foundation of the reservoir.

Prepayment Meter Robbers Sent to Prison.—Two men at Birmingham, who were charged with loitering in Great Barr Street, with intent to commit a felony, have been sentenced to three months' hard labour. The police evidence showed that they were seen trying doors, and it was stated that they belonged to a gang of men who got their living by robbing prepayment meters in the suburbs—a form of larceny of which there had been a great many complaints.

Street Explosion at Normanton.—Some alarm was caused in a Normanton street last Thursday morning by a loud explosion, which broke many windows in the adjoining houses. It appears from an account of the accident in the local Press that some of the Gas Company's men discovered a leak in a service 2 feet below the surface of the street. A light was applied, when the flames spread to the sewer, and ignited the accumulated gas, which exploded. The heavy manhole cover was forced into the air; but beyond a severe shock, two of the workmen escaped unhurt, while the third complained of injuries to his back.

The Dangers of Mond Gas.—On Monday last week, eleven persons had a narrow escape in consequence of an escape of gas from a main connected with the works of the Mond Gas Company at Dudley Port. They all lived in a house at Tipton, and were found by a policeman, who was called to the place in the early hours, to be suffering from gas poisoning. They fortunately recovered after prompt attention by a medical man; but there was great loss of life in the poultry yard—28 fowls, 12 ducks, and other live stock in outhouses having been asphyxiated. The gas had escaped from a service-pipe some distance from the house.

Typhoid Epidemic Litigation at Lincoln.—There are no less than 77 cases in the solicitors' hands which have been brought against the Lincoln Corporation in connection with the recent typhoid epidemic. But so far only three writs have been served; and it is anticipated that these will be regarded as test actions. The Finance Committee have decided, in the interests of the ratepayers, to defend the cases to their utmost power. The matter is a momentous one for Lincoln; for should the actions be lost, an enormous burden will fall upon the ratepayers. Besides the cases that are in legal hands, the Corporation have received nearly a hundred claims from sufferers for out-of-pocket expenses.

Promotion of a Gas Bill by Wolstanton.—The Wolstanton United Urban District Council have instructed the Clerk (Mr. E. Hollinshead) to take the necessary steps to promote a Bill in the next session of Parliament having for its object to purchase the Chesterton Gas Company's undertaking, and to acquire lighting powers over the whole district. The Clerk had previous to this read a communication from the Local Government Board with reference to the Council's proposal to apply for a Provisional Order to light the whole of the urban district by gas, pointing out that the case was not one in which the Board could issue a Provisional Order, and advising the Council to proceed by Bill.

Croydon Chamber of Commerce and Street Lighting.—At the last meeting of the Public Facilities Committee of the Croydon Chamber of Commerce, the circular letter, addressed by the South Suburban Gas Company and the Croydon Gas Company jointly, to the Croydon County Council, on the subject of the cost of public lighting, was considered. It will be remembered that the letter contained a suggestion that the Corporation should set apart a certain representative length of streets in the districts of the respective Companies, and allow them to light them with incandescent gas, high pressure or otherwise, or both, as the Corporation may decide, with or without a limit of price per mile of street, and in a manner which, if adopted by the Council, would represent to the ratepayers an annual saving equal to at least a rate of 1d. in the pound, and which, it was contended, would compare favourably with the present electric arc lighting. A resolution was unanimously passed recording the opinion of the Committee that the request of the applicants should be acceded to, and, pending the result of the experiments, the further consideration of the question should be deferred.

Progress in River Purification.—The Mersey and Irwell Joint Committee, at their meeting on the 7th inst., received from Sir Henry Roscoe a communication with regard to the progress of the work of the Committee during the fourteen years he has acted as its chemical adviser. He recalled that in 1891 he was consulted by Sir John Hibbert as to the desirability of adopting standards of purity and of dealing with questions of river pollution. He pointed out at the time the impracticability of at once fixing any definite standards, and recommended the Committee to insist on all manufacturers using the "best practicable means for rendering their effluent harmless." They acted on this recommendation, and the success which had attended their efforts to prevent river pollution had been substantial. At the end of 1893, out of 390 works producing trade effluents, 45 had created efficient works of purification; 77 had works constructed which were not efficient; in 77 cases, works were being constructed; and in 191 cases no treatment had been adopted. If these results were compared with those obtained in 1904, important progress would be seen to have been made. Out of 444 works then producing trade effluents, no fewer than 306 had efficient works of purification; in 133 cases, works were constructed which were not efficient; and in 5 only no treatment had been adopted.

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Ornamental Design.

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Ball Fuel Fire.

Price 45/-.

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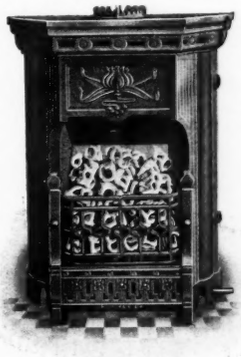
Nursery Pattern with Boiling Ring on Top.



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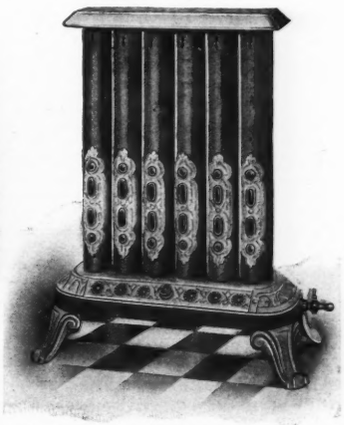

Price 42/6.

LONDON, GLASGOW, FALKIRK.

The Gas Committee of the Darlington Corporation have opened a show-room in the town, so that consumers are saved the trouble of going to the gas-works to select gas cookers and fires, which the Committee let on hire at low rentals, and fix free.

Mason's Gas Power Company, Limited, of Manchester, have inaugurated a course of lectures for the benefit of their staff; the object being to increase the efficiency of the employees. The effort is much appreciated by the staff. Among the lectures which have been arranged for, one is on "Types of Gas-Fired Furnaces."

Plans were submitted by Mr. F. Bergin, at a special meeting of the Birr Urban District Council, of two schemes for a high-pressure water supply for the town, including also provision for the military barracks—one a pumping scheme from Springfield Mills, at an estimated cost of £5600; and the second a gravitation scheme from Ballyshane, entailing a pipe-line for 7 miles, and a cost of £7700. It was unanimously decided to adopt the gravitation scheme, and to have the matter pressed forward as quickly as possible.

During a special meeting of the Newcastle-on-Tyne City Council, to wind up the year's business, the electric light failed; and the debate was continued in the dark.

We learn from Messrs. Spencer, of Elland, that since their hurdle grid was put upon the market, rather more than six months ago, upwards of 100 purifiers have been completed, and orders are now on hand for more than 50, for London, Liverpool, Birmingham, South Shields, Longwood, Perth, and elsewhere. These grids can be fitted to existing purifiers without stopping the working.

The Selby Urban District Council have accepted the following tenders, amounting to £11,311, in connection with the construction of their proposed new water-works; Messrs. Parker and Sharpe, of York, for the construction of the reservoir at Brayton Barff, £4336; Messrs. Harold Arnold and Sons, of Doncaster, for the erection of engine and boiler house, £2925; the Stanton Iron-Works Company, of Nottingham, for the supply of mains, £2765; and Messrs. T. Egan and Sons, of Bradford, for the laying of the mains, £1284.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GENERAL FITTER. Wigan Gas Department.
GAS-FITTER. No. 4500.
STOKER AND RETORT HOUSE FOREMAN. No. 4502.

Situations Wanted.

MANAGER OR MANAGER AND SECRETARY. No. 4496.
ASSISTANT-MANAGER OR WORKS FOREMAN. Tully, New Southgate.
ACETYLENE GAS FITTER. Yeatman, Milton-under-Wychwood.
REPRESENTATIVE OF GOOD FIRMS. No. 4501.

Tank Waggons Wanted on Hire. No. 4493.

Plant, &c., for Sale.

ENGINES, PUMPS, AND BOILER. Clevedon Water Company.

Company Meeting.

ORIENTAL GAS COMPANY. Offices. Nov. 22. Twelve o'clock.

Stocks and Shares.

COMMERCIAL GAS COMPANY. Dec. 5.
CRAYS GAS COMPANY. Dec. 5.
HORLEY GAS COMPANY. Nov. 21.
RIDDINGS GAS COMPANY. Dec. 1.
SOUTH ESSEX WATER COMPANY. Nov. 21.
SOUTH STAFFORDSHIRE WATER COMPANY. Dec. 8.
SOUTHEND WATER-WORKS COMPANY. Dec. 5.
TOTTENHAM AND EDMONTON GAS COMPANY. Dec. 4.

TENDERS FOR,

Fire-Clay Goods.
LEEDS GAS DEPARTMENT. Tenders by Nov. 25.
SHEFFIELD GAS COMPANY. Tenders by Dec. 1.

Oxide of Iron.
SALFORD GAS DEPARTMENT. Tenders by Nov. 23.

Retort Settings.
SAFFRON WALDEN GAS DEPARTMENT. Tenders by Nov. 27.

Sulphuric Acid.
ALDERSHOT GAS AND WATER COMPANY. Tenders by Dec. 1.

Tar and Liquor.
ALDERSHOT GAS AND WATER COMPANY. Tenders by Dec. 1.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 447.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p.c.	21½—22½	..	4 13 4
160,000	10	,,	7½	Do. 7 p.c.	14½—15½	..	4 16 9
200,000	5	May 12	6½	Bombay, Ltd.	6½—7½	..	4 9 8
40,000	5	,,	6½	Do. New, £4 paid	5½—5½	..	4 10 6
59,000	10	Aug. 31	14	Bourne-mouth Gas and Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	29—30	..	4 13 4
51,810	10	,,	7		17—18	..	3 17 9
53,200	10	,,	6		15½—16½	..	3 12 9
380,000	Stk.	Aug. 16	12½	Brentford Consolidated	258—263	..	4 15 1
300,000	,,	,,	9½	Do. New	197—202	..	4 14 1
90,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
206,250	,,	June 15	4	Do. 4 p.c. Deb.	103—106	..	3 15 6
220,000	Stk.	Sept 15	11½	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Sept. 28	10	British	42½—43½	..	4 11 11
100,000	Stk.	Aug. 16	6	Bromley, Ord. 5 p.c.	120—123	..	4 17 7
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—93	..	4 16 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12½—13	..	5 7 8
250,000	Stk.	June 29	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
150,000	20	July 13	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 28	10	Cape Town & Dis., Ltd.	17—17½	..	5 14 3
100,000	10	Oct. 27	4½	Do. 4½ p c Pref.	10—10½	..	4 5 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54*	..	5 11 1
50,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	102—104	..	4 6 7
1,434,680	Stk.	Aug. 31	5½	Commercial 4 p.c Stk.	115—118	..	4 8 1
560,000	,,	,,	5	Do. 3½ p.c. do.	112—115	..	4 6 11
450,000	,,	June 15	3	Do. 3 p.c. Deb. Stk.	86—88	..	3 8 2
800,000	Stk.	,,	6½†	Continental Union, Ltd.	122—125	+4	5 4 0
200,000	,,	,,	7	Do. 7 p c Pref.	140—145	+2	4 16 7
424,070	Stk.	—	5½	Derby Con. Stk.	—	..	—
55,000	,,	June 3	4	Do. Deb. Stk.		..	
486,090	10	July 28	11	European, Ltd.	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	14½—15½	..	5 6 5
15,223,235	Stk.	Aug. 16	4⅛	Gas-light and Coke } 4 p.c. Ord.	100—101	+½	4 7 2
2,600,000	,,	,,	3½	3½ p.c. max.	90—92	..	3 16 1
3,799,735	,,	,,	4	4 p.c. Con. Pref.	110—113	..	3 10 10
4,193,975	,,	June 15	3	3 p.c. Con. Deb.	86—88	..	3 8 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	98—101	..	4 19 0
70,000	10	Oct. 13	11	Hongkong & China, Ltd.	19½—20½	..	5 7 4
3,800,000	Stk.	May 12	10	Imperial Continental	219—222	+1	4 10 1
473,600	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb Red.	96—98	..	3 11 5
175,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	123—128	+1	4 13 9
561,000	Stk.	Aug. 16	10	Liverpool United A.	234—236	+1	4 4 9
718,100	,,	,,	7	Do. do. B	172—174	..	4 0 6

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
306,083	Stk.	June 29	4	L'rpool Unit'd Deb. Stk.	111—113	..	3 10 10
75,000	5	,,	5	Malta & Medn., Ltd.	4⅛—5	..	5 0 0
560,000	100	Oct. 2	5	Met. of } 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 31	3½	Monte Video, Ltd.	12—13	..	5 7 8
1,565,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	106—108	..	4 5 8
406,025	Stk.	June 29	3½	Do. 3½ p.c. Deb.	99—101	..	3 9 4
15,000	10	Aug. 31	10	North Middlesex 10 p.c.	18½—19½	..	5 2 7
52,940	1/	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 12	8	Oriental, Ltd.	150—153	+3	5 4 7
600,000	5	Sept. 14	7	Ottoman, Ltd.	6—6½	..	5 7 8
168,255	Stk.	—	6¼	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	6	Primitiva Ord.	6⅛—7	..	4 5 9
796,980	5	July 28	5	Do. 5 p.c. Pref.	5⅞—5⅞	−⅛	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
851,070	10	Oct. 13	7	River Plate Ord.	12⅞—13¼	..	5 5 8
300,000	Stk.	June 29	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Sept. 28	7	San Paulo, Ltd.	13—13½	..	5 3 8
70,090	50	July 1	5	Do. 5 p.c. Deb.	51—53	..	4 14 4
135,700	Stk.	Sept. 14	10	Sheffield A	243—245	..	4 1 8
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,498	,,	,,	10	Do. C	243—245	..	4 1 8
126,106	Stk.	Aug. 31	5½	Shrewsbury Ord. 5 p.c.	104—106	..	5 3 9
70,000	10	Sept. 28	10	South African	15⅝—16⅝	..	6 1 3
6,250,000	Stk.	Aug. 16	5½	South Met., 4 p.c. Ord.	130—132	+3	4 3 4
1,895,445	,,	July 13	3	Do. 3 p.c. Deb.	87—89	..	3 7 5
575,000	Stk.	Aug. 16	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
112,533	,,	July 13	5	Do. 5 p.c. Deb. Stk.	132—137	..	3 13 0
502,310	Stk.	May 12	5	Southampton Ord.	111—114	..	4 7 9
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Aug. 31	6¼	Tottenham } A 5 p.c.	122—125	..	5 0 0
363,020	,,	,,	4¼	and } B 3½ p.c.	96—99	..	4 16 0
125,000	,,	June 29	4	Edmonton } 4 p.c. Deb.	105—108	..	3 14 1
182,380	10	June 15	8	Tuscan, Ltd.	9¾—10½	..	7 16 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
30,000	Stk.	Aug. 16	7½	Wands-worth } A 5 p.c.	—	..	—
255,636	,,	,,	6¼	B 3½ p.c.	137—140	..	4 9 3
60,000	,,	,,	5 17/20	and } C 3½ p.c.	113—116	..	4 13 6
57,564	,,	June 29	3	Putney 3 p.c. Deb. Stk.	82—85	..	3 10 7
745,872	,,	Aug. 16	5	West Ham 5 p.c. Ord.	105—107	+1	4 13 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	122—125	..	4 0 0
193,300	,,	June 29	4	Do. 4 p.c. Deb. Stk.	104—109	..	3 13 5

Prices marked * are "Ex. div." † Next dividend will be at this rate.

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THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.
Chief Office: 709, Old Kent Road, London, S.E.
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THE Water and Gas Debenture Share Investment Trust, Limited, of 37, High Street, Tunbridge Wells, are prepared to Invest £10,000 Capital in above, and also to Underwrite Progressive Water and Gas Companies' issues.

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Address W. J. YEATMAN, Ivy Cottage, Milton-under-Wychwood, OXFORD.

GAS Engineer about to open Office in Manchester, desires to REPRESENT in that District One or Two good Firms doing Business with Gas-Works.
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State Age and all Particulars to No. 4502, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, by a Glamorganshire Gas Company, a GAS-FITTER, accustomed to House Fitting in Iron and Compo., and Main and Service Laying. State Age, Wages, and whether Married.
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COUNTY BOROUGH OF WIGAN.
(GAS DEPARTMENT.)
WANTED, a good General Fitter for the Works (not outside).
For Particulars, apply to the undersigned.
References, not Testimonials, required.
J. TIMMINS, M.Inst.C.E.,
Engineer.

GENERAL MANAGER.
WANTED, a General Manager for a Gas Engineering and Constructional Works in the Midlands. Must be well up in Estimating, Management of Men, and the Introduction of up-to-date Labour-Saving Machinery, &c.
Address, stating Age, Experience, and Salary required, to No. 4499, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED to Hire, Railway Tank Waggons to carry Tar or Liquor.
Apply to No. 4493, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR Disposal, One set of Engines, Pumps, and Boiler. Capacity, 16,000 gallons per hour. By Stothert and Pitt, Bath.
For Particulars, apply to Jos. HARGER PYE, Assoc. M.Inst.M.E., Manager, Clevedon Water-Works, Company, Limited, SOMERSET.

OXIDE OF IRON.
(NATURAL.)
BALE & CHURCH will be pleased to send Quotations and Samples on application.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT for all Retort and Furnace work.
PAINT for Gasholders, Purifiers, &c.
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(with which is amalgamated WM. PEARCE & SONS, LTD.,
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
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Telephone: 341, AVENUE.

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J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)
THE Gas Committee invite Tenders for the purchase of about 1100 Tons of SPENT OXIDE.
Further Particulars and Form of Tender may be obtained on application to Mr. William W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.
Sealed Tenders, endorsed "Tender for Oxide," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m. on Thursday, the 23rd of November, 1905.
L. C. EVANS,
Town Clerk.
Town Hall, Salford,
Nov. 9, 1905.

FIRE-CLAY GOODS.
THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of SILICA and FIRE-CLAY GOODS required at their Neepsend, Effingham Street, and Grimesthorpe Stations during the next Twelve Months.
Specifications and Forms of Tender may be obtained upon application to the Company's Engineer, Mr. J. W. Morrison.
The Directors do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, marked "Tender for Fire-Clay Goods," must be delivered by post to the undersigned not later than the first post on Friday, Dec. 1, 1905.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street,
Sheffield, Nov. 10, 1905.

LEEDS CORPORATION GAS-WORKS.
THE Gas Committee are prepared to receive TENDERS for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, FIRE-BRICK LUMPS, and FIRE-CLAY.
Specification and Form of Tender may be obtained on application to Mr. R. H. Townsley, General Manager, Gas Department, at his Office, East Parade, Leeds.
Tenders, endorsed "Fire Goods," must be delivered at the Town Clerk's Office, not later than Saturday, the 25th inst.
The Committee do not bind themselves to accept the lowest or any Tender.
ROBERT E. FOX,
Town Clerk.
Town Hall, Leeds,
Nov. 11, 1905.

ALDERSHOT GAS AND WATER COMPANY.
THE Directors are prepared to receive and consider TENDERS for the following:
The purchase of surplus TAR (approximately 1300 Tons) produced at their Gas-Works, Ash Road, Aldershot (private Siding into Works, Tongham Station, L. & S.W. Rly.), for a Year, from Jan. 1 to Dec. 31, 1906.
Specifications and Conditions can be obtained on application.
Tenders to be sent in to the undersigned, endorsed "Surplus Tar," to arrive not later than Nine a.m. on Friday, Dec. 1, 1905.
The highest or any Tender not necessarily accepted.
The supply and delivery of best SULPHURIC ACID, free from Arsenic and Nitrous Compounds, delivered in Tank Waggons (or Carboys, if necessary) to Tongham Station (Company's private Siding, L. & S.W. Rly.), for a Year, from Jan. 1 to Dec. 31, 1906.
Specifications and Conditions can be obtained on application.
Tenders to be sent in to the undersigned, endorsed "Sulphuric Acid," to arrive not later than Nine a.m. on Friday, Dec. 1, 1905.
The lowest or any Tender not necessarily accepted.
By order,
R. W. EDWARDS,
Secretary and General Manager.

"Invaluable to those engaged in lighting works."—ENGINEERING. NOW READY, Price 10/6 net. REVISED TO JULY, 1905.

TWENTY-EIGHTH ANNUAL ISSUE.

GAS-WORKS DIRECTORY AND STATISTICS 1905-6

WITH ALPHABETICAL LIST OF CHAIRMEN, MANAGERS, ENGINEERS, AND SECRETARIES.

SEND FOR PROSPECTUS AND SPECIMEN PAGES,

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ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £10,000 FIVE PER CENT. PREFERENCE STOCK,

AND

£6000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 21, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

HORLEY DISTRICT GAS COMPANY.

NEW ISSUE OF £2000 "B" CAPITAL STOCK AND £2080 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 21, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

COMMERCIAL GAS COMPANY.

NEW ISSUE OF £25,000 THREE PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 5, at Two o'clock, in Lots.

Particulars of the SECRETARY of the COMPANY, at the Offices, Ben Jonson Road, STEPNEY, E.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF £11,500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 5, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

CRAYS GAS COMPANY.

NEW ISSUE OF £5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 5, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

SALE BY TENDER OF £12,500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE, £103 PER CENT.

IN pursuance of the Tottenham and Edmonton Gas Act, 1898, NOTICE IS HEREBY GIVEN, that it is the intention of the Directors of this Company to SELL BY TENDER £12,500 of the above Debenture Stock, to be paid up in full on or before the 18th of December next; such Stock being a portion of additional capital authorized to be raised by resolution passed at an Extraordinary General Meeting of the Proprietors, held on the 20th day of February, 1904, under the powers of the above-mentioned Act.

Particulars and Conditions, with Form of Tender, may be obtained on application at this Office, and sealed Tenders must be sent in not later than Four o'clock in the afternoon of Monday, the 4th of December, 1905.

By order of the Directors,
JAMES RANDALL,
Secretary.

Chief Offices: 639, High Road,
Tottenham, Nov. 3, 1905.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

RIDDINGS DISTRICT GAS COMPANY.

SALE BY TENDER OF FIVE PER CENT. PREFERENCE SHARES.

THE Directors of the Ridding District Gas Company OFFER FOR SALE BY TENDER, 500 FIVE PER CENT. PREFERENCE SHARES of £10 each (or such number of Shares as will produce, including premiums, the sum of £5000).

Minimum Price, £10 per £10 Share.

The last day for the reception of Tenders is Friday, the 1st of December, 1905.

Particulars and Conditions of Sale may be obtained at the Offices of the Company.

By order of the Board,
ERNEST W. DREW,
Secretary.

Offices: 30, Gracechurch Street,
London, Oct. 26, 1905.

SOUTH STAFFORDSHIRE WATER-WORKS COMPANY.

SALE BY TENDER OF £20,000 NEW ORDINARY STOCK, CLASS "B," AND £12,500 NEW FIVE PER CENT. PREFERENCE STOCK, CLASS "F," IN LOTS OF £100 EACH.

(Under the Provisions of the South Staffordshire Water-Works Order, 1901.)

TRUSTEES ARE EMPOWERED BY ACT OF PARLIAMENT TO INVEST TRUST FUNDS IN THIS PREFERENCE STOCK.

THE Directors Hereby Give Notice, that, in accordance with the provisions of the South Staffordshire Water-Works Order, 1901, they are prepared to issue the above-mentioned amount of New Ordinary and New Preference Stock, in Lots of £100 each.

The New Ordinary Stock will rank for dividend with the existing Ordinary Stock of the Company, on which dividends are limited to £7 per cent. per annum.

The Holders of the New Ordinary Stock will have the same privileges as to voting and qualification as the Holders of the existing Ordinary Stock.

The Holders of the New Preference Stock will be entitled to interest, payable Half Yearly, at the rate of, but not exceeding, £5 per cent. per annum out of the profits of the undertaking in each Year.

Tenders may be made for any number of Lots of £100 each for either or both classes of Stock. The latest date for the receipt of Tenders is fixed for Friday, the 8th day of December, 1905.

Notices of Allotment will be sent out by the Company on or before Tuesday, the 12th day of December, 1905; and the date for payment of the whole amount of the Stock and Premiums to the Company's Bankers is fixed for Saturday, the 30th day of December, 1905, after which day the Stock will rank for dividend or interest.

The Allotment will be made, and Certificates will subsequently be issued, free of all cost to the Allottees, who will thus acquire the Stock without payment for stamps, commission, or fees of any kind.

Forms of Tender and any further Information may be obtained upon application at the Company's Office.

By order,
G. J. SPARROW,
Secretary.

Paradise Street,
Birmingham, Nov. 8, 1905.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is Hereby Given, that the Half-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, the 7th inst.—

JOHN HORSLEY PALMER, Esq., in the Chair,

when the following RESOLUTIONS were unanimously passed:—

"That the Report of the Directors upon the affairs of the Association be received, adopted, and entered upon the Minutes."

"That a Dividend of 5 per cent. for the Half Year ended the 30th of June last be declared upon the £8,800,000 Capital Stock of the Association, and that the same be payable, free of Income-Tax, on and after the 14th of November inst."

Cordial Votes of Thanks were passed to the Directors for their able management of the affairs of the Association, to the Chairman for his conduct in the Chair, and to the Staff in London and on the Continent.

By order of the Board,
ROBERT W. WILSON,
Secretary.

21, Austin Friars, London, E.C.,
Nov. 8, 1905.

ORIENTAL GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that an ORDINARY GENERAL MEETING of this Company will be held at the Company's Office, Finsbury House, Blomfield Street, London, E.C., on Wednesday, the 22nd day of November, 1905, at Twelve o'clock noon precisely, for the following purposes: To receive the Directors' Report and the Accounts of the Company for the Year ended the 30th of June, 1905, to declare a Dividend, and to elect Directors and Auditors in the place of those retiring.

The TRANSFER BOOKS WILL BE CLOSED from the 18th of November to the 2nd of December, both days inclusive.

By order of the Board,
H. J. LUFF,
Secretary.

Finsbury House, Blomfield Street,
London, E.C., Nov. 13, 1905.

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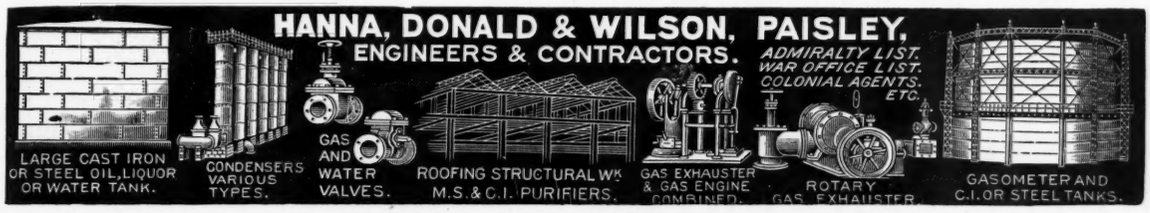
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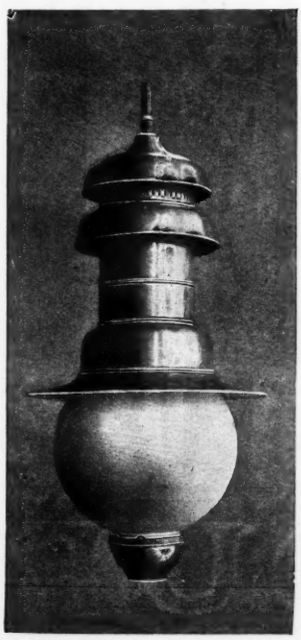

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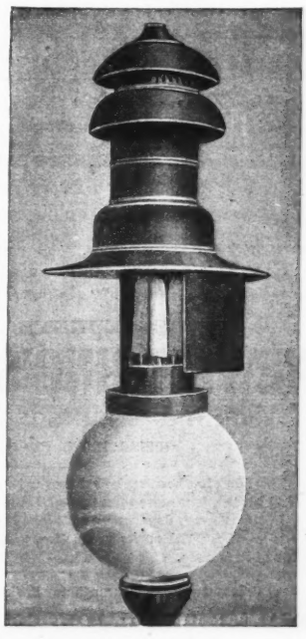
Globe lowered, showing wind-proof shield with door open for access to Mantles. Bottom cup can be removed for Globe cleaning.



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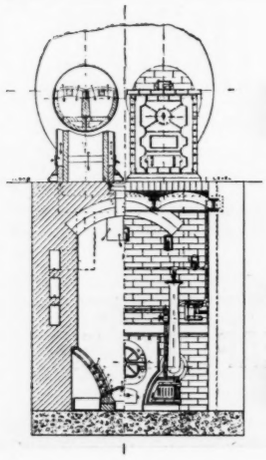

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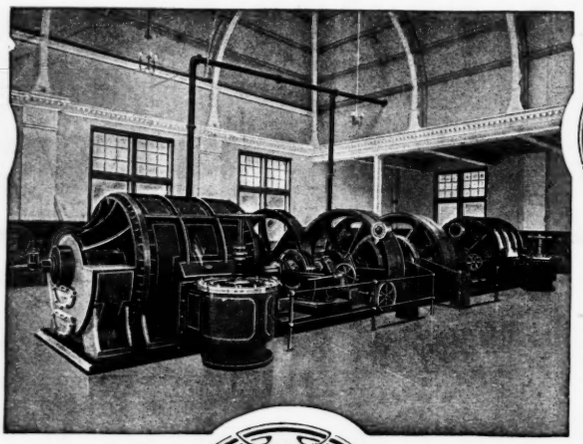
R. LAIDLAW & SON, LIMITED

GAS & WATER ENGINEERS,



SIMON SQUARE WORKS, EDINBURGH.

6 LITTLE BUSH LANE, LONDON, E.C.

TWO EXHAUSTERS EACH TO PASS 750000 CUB. FT. PER HOUR AT 60 REVOLUTIONS PER MINUTE DRIVEN BY TWO GAS ENGINES

AND INTERMEDIATE FRICTIONAL GEARING, ERECTED AT GRANTON GAS WORKS FOR EDINBURGH & LEITH GAS COMMISSIONERS.

ALLIANCE FOUNDRY & ENGINEERING WORKS, GLASGOW.

D. HULETT & CO., LTD.,

55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

PRICE LISTS ON APPLICATION.

THE VERAX-VERITAS,

HIGH-POWER LANTERN.

For One, Two, or Three Burners.

Each VERAX Burner gives 200 C.P. at ordinary pressure.

An exclusive constructional feature:

No fixing screws in outside casing, therefore no trouble with screws through rust or vibration.

UNSURPASSED FOR DOCKS, SHOP FRONTS, AND ALL EXPOSED POSITIONS.

Illustrated List post free on application.

FALK, STADELMANN, & CO., LTD.,

AND AT 74, 76, & 78, Gt. Clyde St., GLASGOW. 83, 85, & 87, FARRINGDON ROAD, LONDON, E.C.

SAML. CUTLER & SONS,

MILLWALL, LONDON.

GASHOLDERS.
STEEL TANKS.
CONDENSERS.
ROOFS.

JÄGER GRIDS

CAPACITY OF PURIFIERS DOUBLED.
PRESSURE CONSIDERABLY REDUCED.

Special Circular describing the Jäger System of Purification on application.

CARBURETTED WATER GAS

Maximum Efficiency Guaranteed.

A LARGE NUMBER OF PLANTS IN OPERATION.

Every Requirement for Gas-Works.

(196.)

Wrought-Iron
TUBES
And Fittings & Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

IMPORTANT NOTICE.

It is the practice of the "Gas World" to publish from time to time analyses of the accounts of Gas Undertakings in this Country. A number of such analyses appeared in the issue for September 16, and they show that at Fenton, Longton, Rotherham, and Tipton, some of the highest results were obtained in Gas Made and Coke Sold.

It may be interesting to Gas Engineers to learn that at these four places Winstanley's Settings are in use.

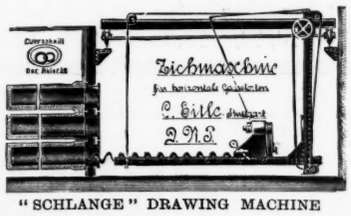
The Winstanley Speciality Company, Newton Chambers, Cannon Street, Birmingham.

C. EITLE, ENGINEERING WORKS, STUTTGART.
Telegraphic Address: "EITLE, STUTTGART." Telephone: No. 635.

"KOBOLD" CHARGING APPARATUS.

ADVANTAGES OF THE "KOBOLD" CHARGING APPARATUS.

1.—The simplest of all existing Charging Machines, as in charging there is only ONE shaft working.
2.—Almost indestructible in construction, as there are no combustible parts exposed to the heat of the Retorts.
3.—Uniform bed of coal of any desired height in the retort, and consequently any desired weight of charge may be inserted.
4.—Greater yield of gas in comparison with all other types, owing to the coal being deposited in the retort most advantageously.
5.—Least inrush of cold air owing to the close fit of the charging mouthpiece with the retort mouthpiece, with consequently practically no cooling of the retort, the least outrush of flame and smoke, and therefore smallest loss of gas.
6.—Smallest consumption of power.
7.—Most rapid working, as the complete charging of a retort requires only two pulls of a lever.
8.—May be set at any position in regard to height by either manual or motor power.
9.—Lowest cost to purchase; paying interest and redemption in about three years.



"SCHLANGE" DRAWING MACHINE

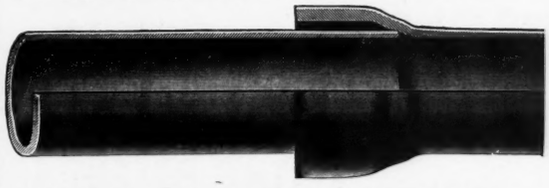
ADVANTAGES OF THE "SCHLANGE" DRAWING MACHINE.

1.—The simplest and best drawing machine in the world for horizontal retorts.
2.—Least time required to draw a retort (10-15 seconds).
3.—Most careful treatment of the lumps of coke, as well as the retort.
4.—Smallest consumption of power.
5.—Lowest cost to purchase.
6.—Most substantial construction, and consequently very low maintenance charges.
7.—Rapid and cheap working, consequently pays interest and redemption in a few years.

FIG. I. 441.

NEW SOLID COPPER CASE LAMP
With Patent Bye-Pass Lever Cock
FOR INVERTED
INCANDESCENT
GAS BURNERS.
Manufactured by
GUEST & CHRIMES,
FOUNDRY & GENERAL BRASS WORKS,
ROTHERHAM.

MANNESMANN



WELDLESS STEEL SPIGOT AND FAUCET PIPES

In any Length up to 40 feet for

GAS & WATER MAINS.

A PERFECT SUBSTITUTE FOR CAST-IRON MAINS.

— THE —

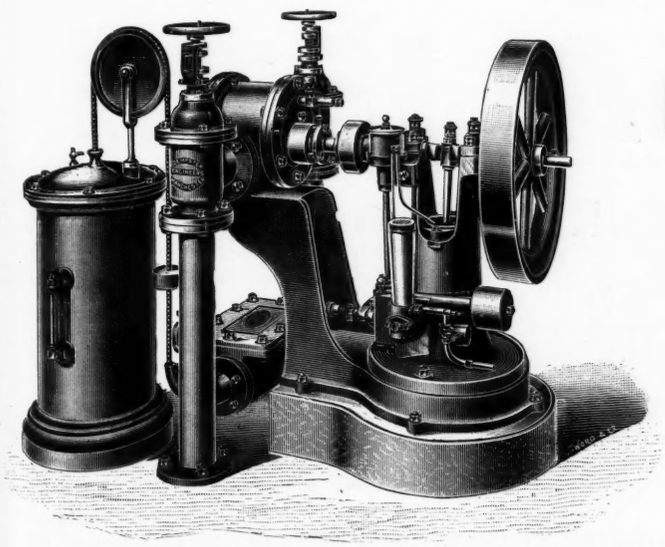
BRITISH MANNESMANN TUBE Co.,

— LIMITED, —

110, CANNON STREET, LONDON, E.C.

R. & J. DEMPSTER, LIMITED, MANCHESTER.

Telegraphic Address: "SCRUBBER, MANCHESTER."
National Telephone Nos. 54 and 2296.



COMBINED ROTARY

Exhausters & Gas-Engines

FOR

SMALL GAS-WORKS.

10 to 15 per cent. increased yield per ton of Coal Carbonized.

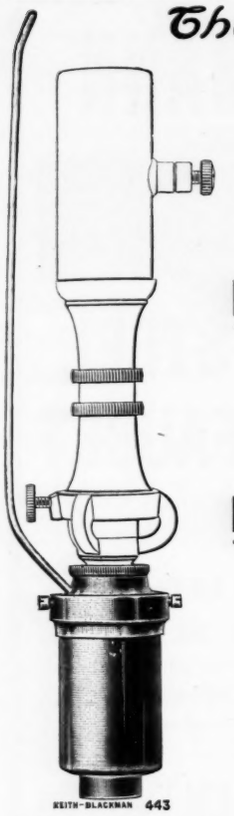
Cost repaid in 2 to 3 Years.

Size of building 10 ft. square inside.

Capacities 500 to 6000 cubic feet per hour.

Full Particulars and Quotation on Application.

London Office: 165, GRESHAM HOUSE, OLD BROAD ST., E.C.



Automatic Bye-Pass.

The **KEITH LIGHT.**

INTENSIFIED INCANDESCENT GAS.

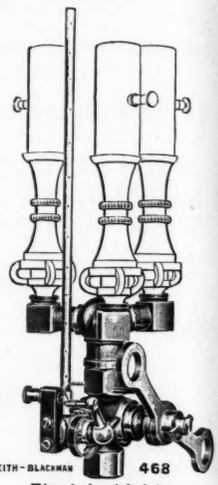
2000 INSTALLATIONS NOW IN USE.

KEITH'S PATENT AUTOMATIC BYE-PASS

places Gas on an equal footing with Electricity as far as Lighting and Extinguishing are concerned. *For full Particulars see 1904 Catalogue.*

KEITH'S PATENT ELECTRIC LIGHTERS

are made for single burners or clusters of burners. Simple in construction, certain in action. Save in bye-pass gas their own cost in six months. Suitable for both High and Low Pressure Gas. Particularly approved of by Insurance Companies.



Electric Lighter for Cluster.

Patentees and Manufacturers:

JAMES KEITH & BLACKMAN CO., LTD., 27, FARRINGDON AVENUE, LONDON, E.C.

CLAPHAM BROS., LTD.

ESTABLISHED OVER 60 YEARS.]

KEIGHLEY.

SPECIALISTS

IN THE MANUFACTURE OF **CONDENSERS, WASHER-SCRUBBERS,** AND

TAR EXTRACTORS, VALVES, MAINS, DRY LUTE PURIFIERS.

CARBONIZING PLANTS, FOR INCLINED OR HORIZONTAL SYSTEMS. LAMP COLUMNS, TANKS, ETC.

London Representatives: Messrs. JONES & YOUNGER, Chesterfield House, 98, Great Tower Street, E.C.
Scotch Representative: JOHN D. GIBSON, 74, York Street, Glasgow.

Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Nov. 14, 1905.

TRUTH

An Old Proverb—

"Those who live in glass houses should not throw stones" (or mud).

NOT

FICTION.

132, QUEEN VICTORIA STREET,
LONDON, E.C.
Nov. 11, 1905.

To the GAS PROFESSION.

GENTLEMEN,—We have disregarded the unwarrantable past advertisements of our opponents and treated them with the contempt they deserve; but it seems now necessary and desirable for us to contradict statements which, in our opinion, are grossly misleading.

Their **RADIATOR** inset in October, in both papers, the JOURNAL OF GAS LIGHTING and the GAS WORLD, states:—

> "**We have ALWAYS been FIRST.**
> "Why risk buying the **COPY** when you can get the **ORIGINAL?**
> "**It is better** to have the Radiators made by the firm who **always design** than those put together by the firms who **always copy.**"
> "Why should copyists get their experience at your expense?"

The illustrations opposite show—

FIG. 1 A Gas-Steam **RADIATOR** supplied March 12, 1900, to our Dublin Branch, and which may now be seen there, made by the Exeter "Gasteam" Radiator Co., Ltd., late of 17, Shaftesbury Avenue, W. **Observe the design, the automatic gas regulator, and water gauge,** and this was made prior to **1900, NEARLY 6 YEARS AGO.**

FIG. 2. A Gas-Steam Radiator, made by our opponents, and they state that theirs were put on the market two years ago (*i.e.*, **October 1903**). **Observe the design, automatic gas regulator, and water gauge. COMPARE** their Radiator made in **1903** with that on the market in **1900.**

Their boasted claim to being originators of the Gas-Steam Radiator is therefore unfounded, and consciously, or unconsciously, **UNTRUE;** for undoubtedly theirs appears to be a **DIRECT COPY** of the **EXETER RADIATOR.**

Yours Obediently,

THE RICHMOND GAS STOVE &
METER CO., LTD.

The ORIGINAL.

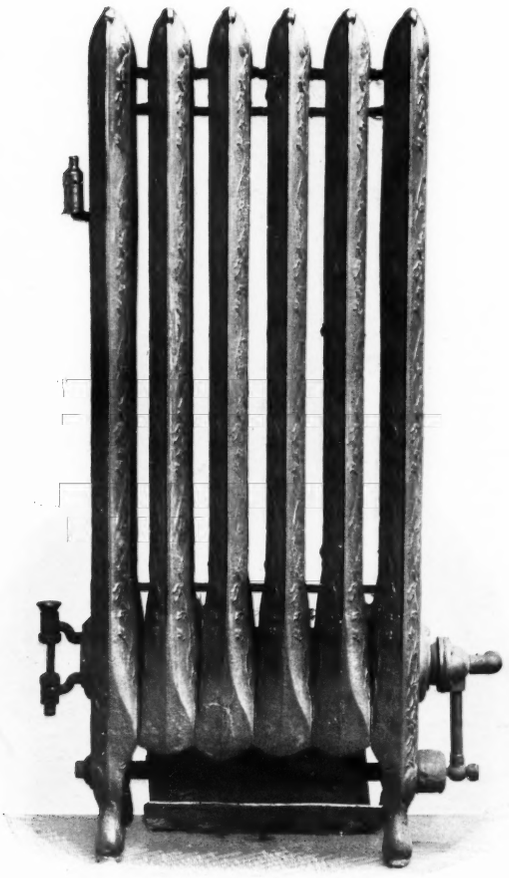


FIG. 1.

On the Market and at Dublin Showroom

1900.

The Exeter "Gasteam" Radiator Co., Ltd.

Piccadilly Mansions,
17, Shaftesbury Avenue, W.
London, March 15th, 1900.

Gentlemen,—

We beg to hand you herewith invoice for radiators as per your orders No. 96 which were shipped by the L. & N. W. Ry. on the 12th inst.

We have allowed you 25 per cent. discount off our list prices.

Please note carefully the note on the bottom of the instruction card regarding the smell from the paint during the first few times the Radiator is used.

Yours faithfully,
The Exeter "Gasteam" Radiator Co , Ltd.

Is this a COPY?

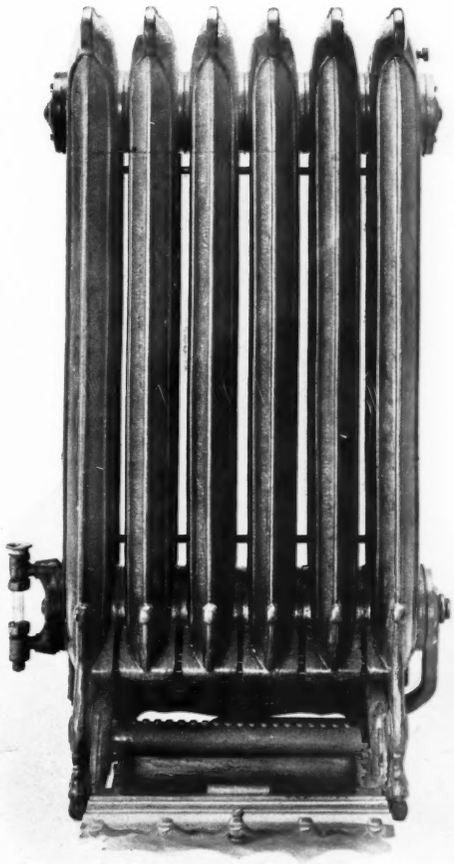


FIG. 2.

Made by our opponents years later.

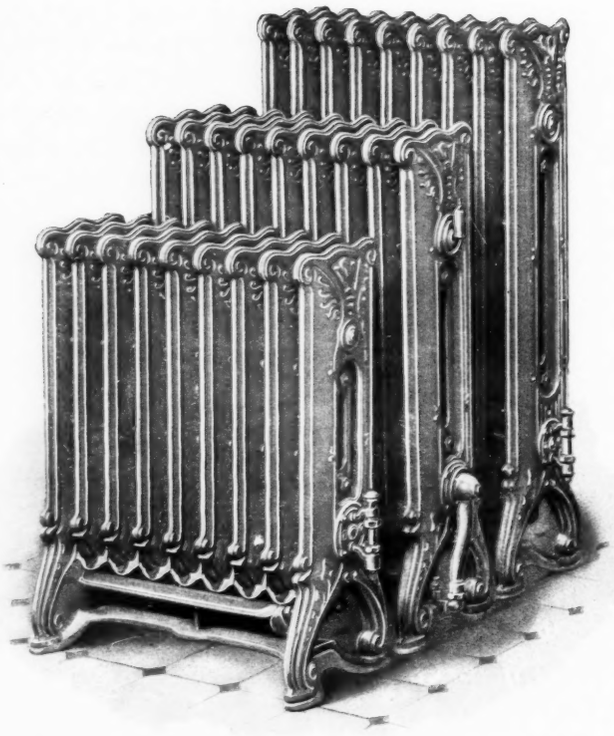
And yet they say other makers are "Copyists" !!

P.T.O.

RICHMOND'S

"MONARCH" GAS-STEAM RADIATOR.

The Latest and Most Up-to-Date.



Embodies all Latest Improvements.

RICHMOND GAS STOVE & METER CO., LTD.

Works and Offices: Academy Street, Warrington, and Carpenters Road, Stratford.
London Showrooms and Offices: 132, Queen Victoria Street, E.C.
Also at Chelsea, Oldham, Dublin, Manchester, Leeds, etc.

Printed for Walter King, by King, Sell, & Olding, Ltd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Nov. 14, 1905.

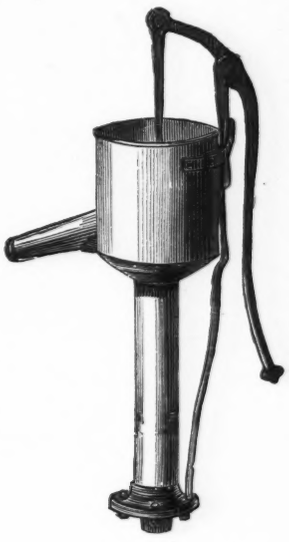
Buy of the Actual Makers!!

HULETT'S SERVICE CLEANSER OR FORCING APPARATUS.

No. 1.—Ordinary Size Service Cleanser.
No. 2.—Large Size Service Cleanser.

HULETT'S SYPHON PUMP.

No. 54.
Small Brass Pump.

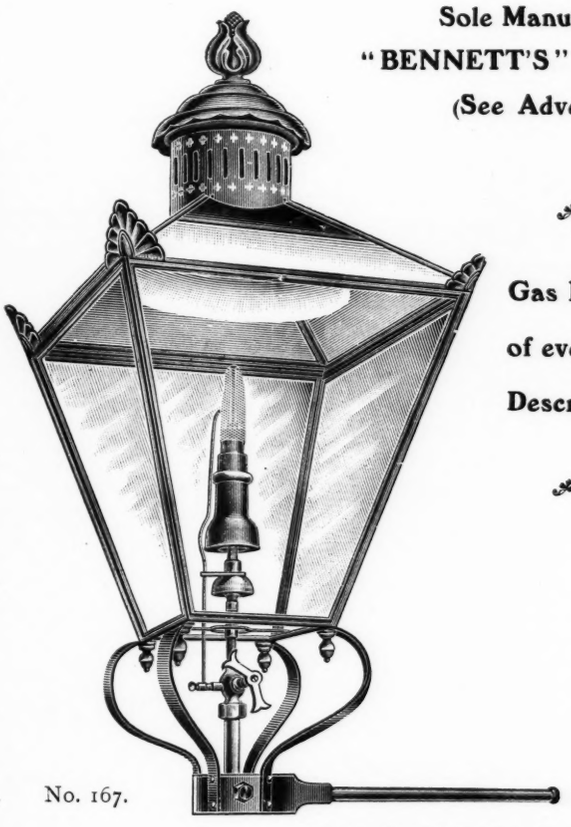


No. 49.
Strong Copper Pump.

Hulett's Outside Street Lamps.

Sole Manufacturers of
"BENNETT'S" PATENT LAMP
(See Advertisement).

Gas Fittings of every . . . Description.



No. 167.

No. 172 I.

See Reduced Prices in Supplementary List, 1905-6.

D. HULETT & Co., Ltd., 55 & 56, High Holborn, London.

Established 1818. **GAS ENGINEERS.**

Printed for Walter King by King, Sell, & Olding, Ltd.; and Published by him at 11, Bolt Court, Fleet Street, London.—Tuesday, Nov 14 1905.